VOL. LXXXVII. No. 2236. [All Rights Reserved.] OCTOBER 1, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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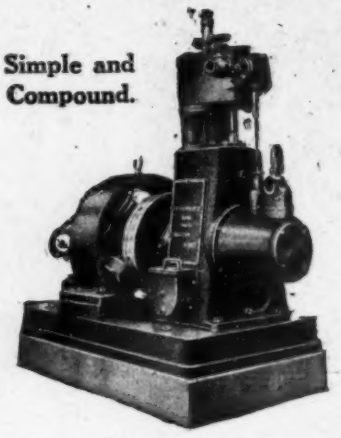

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ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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UNITED KINGDOM	***£1***	***14***	***8 per annum.***
CANADA	***1***	***12***	***6 do.***
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A NEW ARMISTICE?

WE suppose more has been written on the subject of industrial unrest during the last year or two than on any other. Whichever way the editor turns in his office or out of it he is met with books, pamphlets, or newspaper articles relating to it, the cost of printing and paper notwithstanding. And why? Because, we optimistically will say, men are legitimately in search of those better conditions of life for which we all long, and because, we pessimistically would add, they are prevented from attaining those better conditions by the after effects of the costly war which spread the desire and determination to hasten the millennium. These are the legitimate causes of unrest. There are others, among them being the activities of a minority—a small minority, we believe—of extremists and idealists, some of smooth and cultured speech, some of inflammatory oratory and coarse threatenings. Mr. Barnes last week rightly told such that they no more represented the democracy of the country than the Bedouin of the desert. But their influence has to be counteracted, and it has again and again been successfully met by men of the working class who have troubled themselves to study economic and industrial questions, and as a consequence advocate sane and safe measures of reconstruction rather than quack, or will-o'-the-wisp, remedies. They prefer to repair the house in which they live rather than to pull it down before the one they wish to take its place has even been designed.

A contributor in this issue discusses the importance of propaganda, and in this connection we are reminded of the vast literature that has appeared and is still appearing on the industrial questions of the times, but which we fear fails to reach the eyes for which it is prepared.

We have before us as we write, one more pamphlet which is thoroughly deserving of study by all engineers just now. It is an attempt by Mr. D. A. Bremner, Director of the British Engineers' Association,* to diagnose the industrial unrest disease, to describe its symptoms and effects, and to set forth his own ideas regarding suggested remedies. It will not meet with unanimous approval, but that is a merit rather than a defect, for the man who pleases everybody really utters little more than generalisations or sweet nothings. We commend the pamphlet to our readers' attention, for it is brief, and being free from the verbiage that some reconstruction writers see fit to employ, it gets home with ideas that at any rate stimulate thought, and that is all to the good.

Mr. Bremner, as a result of his diagnosis of the disease, finds it to be a morbid state of feeling, an affection of the mind, complicated by ignorance. A difficult case to deal with. The recovery will necessarily be slow, and the use of quack remedies may produce disastrous consequences. Industrial unrest, he holds, is due to impairment of the reason and a weakening of the sense of moral responsibility; yet the treatment required is an appeal to reason, and that can only succeed if the mind be sufficiently trained and educated to respond. Let it not be imagined that dissatisfaction with an existing state of things is necessarily a disease. It may be a sign of health and vitality in the nation—an expression of the will to progress. But it is possible that dissatisfaction with a state of comparative well-being may be destroyed by the fear of losing it; that contemptuous defiance of an under-estimated danger may be converted

* "The Pathology of Industrial Unrest, with some special reference to the Engineering Industry," by D. A. Bremner, British Engineers' Association, 3d.

into a fearful prudence by the revelation of its real nature; and that disinclination to work may be overcome by love for one's dependents, or by the selfish fear of bodily privation.

The writer puts before us in his pamphlet a number of measures which, if promptly and skilfully applied, he considers should help to restore the industrial world to a normal state of health. The education of all classes in the laws of industrial and national economics governing the material well-being of civilised communities in general, and of our own peculiarly situated nation in particular, is one urgent matter, but we cannot look for immediate results in this direction. The pernicious teachings and propaganda of extremists, cranks, and revolutionists must be combated and counteracted. Causes of legitimate discontent should be voluntarily removed or mitigated. There should be a continuous appeal to all that is best in human nature to secure support for sane, practical reconstruction, and less publicity should be given to the passionate utterances of the agitator. Wholesome interests and healthy recreation should be provided which will induce us all to divert our attention from the perpetual study of the anatomy of discontent, and so we will write no more pamphlets on the subject.

Mr. Bremner regards the organisation of the employers to day as being contemptible in comparison with that of labour, and he calls for organisation in large groups, or as one great body, for planning and conducting a common defensive campaign. Presumably the B.E.A., the B.E.A.M.A., the F.B.I., and all the other organisations are inadequate or unsuited to the purpose that he has in view. He advocates the negotiation of a general industrial armistice, whereby conditions could be stabilised for at least twelve months, so that employers and employed might be able to concentrate their energies on obtaining increased production which alone can save the country from economic disaster and the working classes from unemployment, suffering, and privation. He holds also that the presentation by the employers of a convincing case for capitalism, and of reconstructive proposals based on facts and figures, has long been overdue. "Sooner or later sane counsels will prevail, and genuine reconstruction begin in one or other of the great manufacturing countries. The first to recover its stability and regain its power of progression will be the fortunate one for which the future will hold promise and fulfilment."

An industrial armistice was called for shortly after the other armistice was signed. We can hardly say that we have had it—possibly history will prove that it was better to let the steam off as we have been doing. We have been getting through gradually, and possibly every awkward position negotiated, without serious sacrifice of principle, means progress made toward settlement. Sooner or later we shall settle down to reasonable progress, and let us hope, prosperity. We might do far worse than arrange an industrial armistice now, to date from two years after the signing of that other armistice.

Why not, as we stand again at that hour in November, silently remembering those who laid down their lives for us, resolve before Heaven that we will sheathe the sword of the industrial and class warfare for one year, and endeavour in the better atmosphere that would result to settle matters justly and amicably for the common good of all?

Tramways in European Countries.

The question of tramway studies in some European countries in the summer of 1920 was the subject of a paper read by Mr. Einar Hultman, of Malmo, before the annual Conference of the Swedish Tramways Association, which has just been held in Stockholm. The author, who recently paid visits to Holland, Belgium, France, Switzerland, and Germany, stated that the tramway companies and other tramway authorities in nearly all the towns in these countries had begun to think about making alterations in the systems of fares, in order to render the tramways more economically supporting, as the financial results almost everywhere represented "poor business." He was of opinion that, with the present system under which the conductor went about the car to collect fares, and with the continuance of transfer tickets, it would be very risky to increase the size of the cars (single deckers) to any extent. It was already frequently difficult for conductors to collect all the fares, and, therefore, only a simplification of the ticket system would be able to render it possible for the size of the cars to be increased. In the meantime, the conditions were such that the fares could not be raised at the same rate as the advance in the cost of living, without bringing about a decrease in the traffic, which might have fatal results. It had been found in different countries that the basis fares were appreciably below the cost of living. As a consequence, the tramways, which had to pay their personnel full compensation to meet the increased cost of living, and had also to follow the high prices in the matter of all expenses, could not reckon on getting their receipts on a level with the working expenses. Simplification would take place if the conductor could collect the fares of 70 passengers instead of 40, which could also be done by a "stationary" conductor, by the adoption of uniform fares and the booking system, and by the co-operation of the community to the largest possible extent.

Research Funds.

The plea made in the Presidential Address to Section B (Chemistry) of the British Association this year, that industrial undertakings should subscribe more liberally towards pure research in their particular branches of industry, is one which deserves attention from more than one aspect in all industries. The argument put forward in appealing for this financial support for pure research is always based on the incontrovertible fact that it is upon the work of pure science workers that most of our great industries have been founded. Therefore, industry as a whole should support scientific research as distinct from industrial research. Probably the most striking case in point of an industry being founded upon the work of a scientific man who, at the time, had no anticipations of the kind, exists in the electrical industry, and it is often quoted, *i.e.*, Faraday's discovery of electromagnetic induction, which, of course, led to the dynamo and all that followed from that practical invention later. The position of scientific research in this country at the present moment is none too happy despite the importance of it as revealed by the war. Indeed, in this, as in many other directions, most of the good intentions engendered by war conditions have had the bad habit of being forgotten now that the war is over, and, be it fairly added, the minds of our industrial men are harassed by conditions directly affecting their future, which were not contemplated, say, two years ago. It was partly because scientific research as carried out in our universities and other places, apart from works research with an immediate commercial object in view, was so badly supported that the Department of Scientific and Industrial Research was established. That body, as we know, has provided, and still provides, a certain amount of money for scientific research, but for the most part those pieces of scientific research work which it finances, have a reasonably definite object in view in the commercial sense, although the results would be of general application. On the other hand the Department has financed in a generous manner, on the £1 for £1 basis, the industrial research organisations which have been formed; indeed, it is complained by the pure-research people that the tendency is all towards assisting industrial research to the disadvantage of scientific research. However that may be, it would appear that the demand for funds for scientific research is none the less urgent, notwithstanding the existence and the assistance of the Department of Scientific and Industrial Research, and our universities, which are necessarily most concerned, find themselves compelled to

appeal to industry for help. As an abstract proposition, it is undeniably the duty of industry to support scientific research in every possible way. Most industries are now conducted by men who are fully conversant with the manner in which technical progress and prosperity follow upon scientific achievement, and for that reason there is some hope that the position will be viewed in the right perspective. At the same time, whatever excuses industry may have had to offer for its lack of support to research in pre-war days, the fact now is that conditions have changed in a manner not anticipated by the majority, and it would not be surprising if a certain amount of callousness were to make itself evident with regard to financial assistance to anything from which a hard-headed business man could not see an almost immediate, or, at any rate, a direct return. Heavy taxation, high cost of materials, and high cost of, and trouble with, labour, have left most business men in no mood to regard this question of scientific research—and many other similar matters—in the same light as under normal conditions.

Scientific research is a wide term, and one not easy to circumscribe in its scope. The recent example of a large firm of chemical manufacturers in voting £100,000 for pure scientific research has been quoted several times in this connection, and it is one which might well be followed by other wealthy companies, but the one difficulty those who are most concerned with scientific research will always be up against, is that no limit can be set to the amount they require. They are, of course, prepared to snatch up any crumbs which may fall their way in the shape of subscriptions, and, as a general proposition, we agree that industrial firms might well spare a little in this direction, although they will, no doubt, at the same time be subscribing to the funds of their particular industrial research association.

Maximum Prices and Profits.

The Electricity Commissioners have now before them many applications for sanction to increase the statutory maximum prices laid down in Provisional Orders.

The applicants have been required to furnish pretty full statements of accounts, both of capital and revenue, so that the Commissioners evidently mean to take the correct course of forming their decisions on a basis that will give a reasonable rate of profit to the undertakers. But whether the result will be satisfactory depends upon what views the Commissioners take of a "reasonable rate."

Following upon interviews between the Commissioners and the representatives of certain undertakers, an impression has got about that the Commissioners have adopted as a standard a dividend of 5 per cent. and a depreciation rate of a similar amount as adequate. This impression is causing a feeling akin to dismay on the part of supply companies, especially those to whom the lighting load is still the predominant portion of their business.

These companies, like most supply undertakers, are faced with demands from new consumers, involving new capital expenditure for plant, mains, and services. How is capital to be found now for a business in which the divisible profits are limited to 5 per cent.?

Government securities can be bought to-day, redeemable in a few years, which give an equated yield of 6½ per cent. throughout, including the difference between the market price and the redemption rate. Industrial concerns, too, are offering preferred securities yielding 8 per cent. What chance is there for an electricity supply concern to attract capital at 5 per cent.?

Supply companies cannot possibly go forward with their schemes of extension while they remain under this apprehension. The stagnation forced upon them during the last few years must continue.

It has to be said that this view of the Commissioners as to allowable rates of profit, whilst at the moment it relates to the maximum price question, and, therefore, mainly to the lighting load, is likely to have wider extension in the future. Under the Electricity Supply Act of 1919, and such amendment as it may receive in the immediate future, the Electricity Commissioners will be the eventual arbiters of supply prices generally for every purpose. Obviously, the "cheap and abundant" supply which it is their duty to develop cannot be given unless the market rate of capital can be promised by the undertakers. This is true for every class of undertaker—municipal, company, or joint authority.

It seems highly desirable that the Commissioners should relieve the apprehensions which have been raised by a declaration that it is their policy in dealing with prices to allow for all capital a rate of return equivalent to that which rules in the market for similar investments. Otherwise the essential flow of capital into the industry will inevitably be dried up at its source.

Socialisation of Supply Works in Germany.

According to the law of December 31st, 1919, concerning the socialisation of the electricity supply industry, a Bill has to be prepared for the general regulation of the industry, and to be enacted by the beginning of April next year. Reports on the suggested regulations have been made by representatives of the State electricity industry, the municipal electricity departments, and the private supply companies at the first sitting, which has just been held at Berlin, of the Advisory Council set up under the law of last December. The meeting was convened by the Minister of Finance, and after the reports had been discussed, a committee was appointed to advise the Minister in connection with the impending legislative labours. It is proposed to submit the Bill for the consideration of the Federal Council of Economy (Industrial Parliament) in the present year, so as to permit of its being laid before the Reichstag at the beginning of 1921.

There are no indications at present as to the possible form the proposed regulations will assume. In the meantime, the opinion is growing in industrial circles that it will be impossible at any time to separate undertakings which are economically dependent upon one another, as for instance, collieries which are associated with iron and steel works, and that therefore socialisation of these particular coal mines is entirely out of the question. The same argument is now put forward with regard to those electricity supply works which are closely connected with pit coal or lignite mines. A typical instance has arisen in respect of the Rhenish-Westphalian Electricity Works Co., and the Rodder Lignite Mining Co. The former supplies a very large district from its generating stations, and an insignificant part of its share capital of 60,000,000 marks is held by local authorities; funded loans amount to 33,000,000 marks, and credits granted by local authorities reach a further sum of 78,000,000 marks. On the other hand, the mining undertaking, which has an ordinary share capital of 45,000,000 marks, is one of the largest and richest lignite producing concerns in the country, and on the site of its Vereinigte Ville mine the electricity supply company years ago erected the Goldenberg generating station, which is the company's largest works, and is said to be the largest generating station in the West of Europe.

The idea has now occurred to the directors of the two companies that the interests of suppliers of lignite and consumers of this fuel would be best served by the establishment of a working community between the two undertakings, as a preliminary step towards eventual amalgamation. At least, this is the official version given out, but the real reason lies in an attempt to prevent the socialisation either of the electricity undertaking or the lignite coal fields in question. As the two concerns stand at present, they are practically inseparable, but it is desired to render the relationship still more intimate by the electricity supply company taking over the management of the mines, guaranteeing the latter a dividend at the rate of 24 per cent. per annum for 10 years, and having the right of entire absorption of the mines at the end of this period at a purchase price of 600 per cent. In fact, without spending or risking a paper mark for 10 years one of the most prosperous lignite undertakings in Germany is to be handed over to a supply company which is controlled by the Stinnes group of pit coal producers, provided, of course, that the shareholders in the lignite company accept the proposal.

THE POWER OF PROPAGANDA.

By "FEMINA."

On November 11th, 1918, the world was awakened from the hideous nightmare of war to a beautiful dream of peace, which perhaps lasted out the fateful year 1918. Then, like a dissolving view, it began to fade, and gradually gave place to a second nightmare—that darkest hour before the dawn. We begin to wonder whether we that have seen the war through are to behold the true dawn of peace, and to ask ourselves whether it is possible to create a desire for world-peace of the same burning intensity as that desire for world-power that has over and over again in the world's history taken possession of ambitious monarchs and their people. Surely there should be a "will to peace" as well as a "will to power." Ibsen, in "The Master Builder," asks: "Don't you agree with me . . . that there exist special chosen people who have been endowed with the power and faculty of *desiring* a thing, *craving* for a thing, and *willing* a thing so persistently and so inexorably that at last it has to happen?" We do agree with him, for we know that men of this type brought about the Great War, and also that men of this type won the victory. If we are ever to witness the dawn of a true peace, we must find peacemakers endowed with this power and faculty. The true peacemaker must be something more than a reconciler of contending parties, although reconciliation must be the first step. He must be a preventer of strife, and a creator and maintainer of a peaceful atmosphere. He has no easy problem to solve, but, as Campbell-Bannerman used to say: "A way will be found," given the right men and the right methods.

One of these methods that has as yet received far too little attention is the skilful use of propaganda. In this matter, as usual, "the children of the world are wiser in their generation than the children of light." One good result of the Great War is that it has taught the world the value and the power of propaganda. But our enemies realised this value and power long before we did, and used it to our disadvantage until Lord Northcliffe took our own propaganda in hand, and raised it to the level of a fine art.

In matters concerning the domestic policy of this country Labour has made far more use of this weapon than capitalists and employers. Surely it is time that the "hated bourgeois" and the "loathly capitalist" began to use this wisdom of the serpent in self-defence, to counteract the revolutionary and Bolshevist propaganda that is spreading over the community like an evil germ. In this work every man and every woman can take part, for every human being has a sphere of influence, the extent of which depends on the character and personality of the individual. But, generally speaking, this influence is exercised unconsciously, and has yet to be stirred to the glow of enthusiasm and the white heat of fervour.

Propaganda work opens out a new field of activity for writers and artists of all types, and especially for those who, while possessing undoubted talent, have not yet succeeded in getting their work accepted. Newspapers and other periodicals must necessarily be limited in number, and most of these have already their regular contributors; but there is endless scope and endless variety for the efforts of the propagandist.

There is no reason why propaganda in some form or other should not reach even the most out-of-the-way cottage in the country. To be effective it must, like religion, be made "all things to all men." No one should say to-day: "Politics and industrial questions do not interest me," for they are of vital importance to every household in the kingdom. There is already plenty of literature for the intellectual man, the man interested in politics and industry, and the newspaper reader. What is most wanted is propaganda of a lighter kind for the people who cannot be classed under any of these heads.

In the section of the *Times History of the World* that deals with "British Propaganda in Enemy Countries," the secret of the success that attended this work is disclosed in one brief paragraph, in which it is shown that this success depended mainly on the close observance of two great principles:—(1) that propaganda . . . . should form opinion without opinion realising that it is so being formed"; (2) "to tell . . . the plain truth, without *suggestio falsi* or 'deft' interpretation." We shall do well to keep these two maxims in mind for observance both in our own country and abroad. To these two principles, I would add the exclusion of anything vindictive, offensive, or vulgar. We are hoping to influence friends and fellow-countrymen.

The success of the Woman's Movement affords a striking instance of the power of propaganda of the right kind, for it prevailed notwithstanding the opposition of the Press. With certain exceptions, which women will always remember with gratitude, the attitude of the newspaper Press was mainly hostile until the outbreak of the war, when a change of policy became expedient. Leading dailies either practically ignored the movement or opened their columns to hostile propaganda of the kind that I have deprecated, thereby greatly increasing the fierceness and bitterness of the controversy.

There is more scope for variety in propaganda work of the lighter, more popular kind, than in that of the heavier, more serious type; but as yet much more effort has been made in the latter direction than the former. There have been lately several instances of well-chosen, well-written, and well-timed newspaper work. But literature of this type scarcely touches industrial districts, which are simply flooded with revolutionary propaganda for which there is no antidote. It is not too late to find one, but it soon may be, if we do not awaken to the national peril. As in the war, we shall perhaps do well to follow the enemy's example—with a difference. To begin with, we must make a study, as Labour leaders have done, of the art of persuasion. The word "rhetoric" is to-day regarded with some suspicion, being not infrequently defined as "hot air." Yet there is no reason why this art should not be used for the cause of truth, as well as for throwing dust in people's eyes, and gaining assent to fallacies, half-truths, false assumptions, and sentimentalities.

Among the most useful media for propaganda of the lighter type may be mentioned the leaflet, the pamphlet, the novel, or short story with a purpose, the film, the play, the poster, the cartoon, the advertisement, and last, but certainly not least, propaganda for children. In all these forms we shall do well to remember Lord Northcliffe's advice to endeavour to "form opinion without opinion realising that it is so being formed." Lecturing, sermonising, and "talking down" will not do, especially if it is hoped to influence working women who, considering their great importance in industry, have been far too much neglected by the propagandist. Amongst working women we must certainly include the working man's wife, for, according to Sir Robert Hadfield, these wives are "easily the most hard-worked class of the community." Upon them the men's efficiency as working men largely depends, and it is they and their children who suffer most during a strike. It must be brought home to them that they have the right to vote on any matter that vitally concerns them and their children. Women of this class would probably have a very slight chance of defeating Sir Oracle in argument, but they could at least offer fierce opposition to a strike that can only bring misery to them and their children.

Propaganda in the leaflet form should be brief, con-

cise, and convincing, and should have arresting titles and sub-titles, calculated to attract attention at once. In industrial districts there are illuminating "incidents" happening every day that might with advantage be used as object lessons, names, of course, being omitted. Also it might be worth while to turn a powerful searchlight on to some of the catchwords and phrases so beloved by our agitators. Every large employer of labour should have, not only a "publicity" department, but a "propaganda" department.

The importance of propaganda for children has been emphasised by the recent miners' ballot. We cannot blame the young and irresponsible pit-boys, for they have probably never been taught to take work seriously. The people to blame are those who solicited their votes, and were prepared to act upon them. In this matter of juvenile propaganda Labour has forestalled us, as usual. Several years ago there was a great outcry against Socialist Sunday schools. But would it not have been more to the purpose if we had set our own house in order, and made a better use of the opportunities afforded by State-controlled schools and Sunday schools? A character in Mr. Wells's book "Joan and Peter" says: "Give me the schools of the world, and I will make a millennium in half a century."

The British public can always be depended upon to show pluck and endurance in times of stress, but until now the kind of propaganda that might have prevented these crises has been wanting. Every man and every woman can help to "scatter the good seed o'er the land." The fields are ready, but the enemy has been very busy sowing tares.

THE FUNCTION OF THE EARTH IN THE TRANSMISSION OF ELECTRICITY.

By CHARLES E. SNELL.

The experiments which are being carried out under the direction of Major-General Squier (United States Army) with what is termed a system of open circuit "wired wireless," brings into prominence the question of the function of the earth in those systems which make use of earth plates.

As it is probable that it will become necessary at no distant date to revise, if not abandon, many of the present ideas relating to the function of the earth connection, it is proposed to bring to notice the results of the experimental work done by the author, because it would seem that the method of attacking the problem which will be described is capable of affording a more scientific basis for the explanation of the results obtained in practice.

With a view to rendering the appreciation of the latter portion of this article relatively easy, an outline of the salient features of the subject will be given, arranged in the order best suited to the circumstances, that is to say, irrespective of the chronological sequence of discovery. Before passing on, however, a pause may be made to acknowledge, in a general sense, the debt we owe to those early workers in the field of electrical science from whom we have gained so much, and to whom, in too many instances, so little was given. Fortunately for us, and perhaps even for them, their studies were not on a commercial basis, and they were content, therefore, to seek patiently for results with neither the desire nor the need to invoke the aid of the lay Press in advertising their accomplishments; a course followed much too frequently in these days, and often with such haste that the advertisement precedes the result.

In land line telegraphic practice, the earth connection principle is used to replace one of the two conductors which would otherwise be necessary, and the effects of this arrangement are a saving of wire and economy of battery power; the latter being due to the fact that with what is termed a "good" connection to earth the only resistance required to be taken into account is that of the one line wire and the associated apparatus.

The history of this remarkable discovery is obscure, but it can be reasonably assumed that it dates back a considerable number of years—the year 1838 has been mentioned—and it is an indication of the difficulties surrounding the subject, that the present explanations cannot be regarded as satisfactory.

It is usual to assume, when dealing with instances similar to that of land-line working, that one of the two following ideas suffices to explain the function of the earth connection, viz.:—

(*a*) The earth return may be regarded as a perfect path having no resistance. The actual current is not to be considered as traversing the earth between the two points, but the earth should be regarded as a vast reservoir of electricity. On this basis the supposed action of an earth return circuit may be expressed in the terms of this analogy:—Assume a long line of pipe, filled with water, with both ends dipping into the sea, and subjected to the influence of a rotary pump. With the pump at work, water is picked up from the sea at one end and discharged back again at the other. Let the rate be one gallon a minute. Every minute then sees one gallon of water picked up at one end of the pipe, and a precisely equal quantity discharged at the other. Water momentarily accumulates in the sea at one end, and its quantity is reduced at the other. The adjustment is one of general level between the two places, and it is, therefore, not a case of an identical gallon-a-minute stream going back through the sea in the same form that it passed through the pipe. So with an electric circuit; at one end electricity is continually passed into the earth, and at the other continually passes out in exactly equal quantities, the adjustment being one of level merely between the two ends of the circuit.

(*b*) The earth forms a path of practically no resistance, on account of the vast volume of material between the two plates. In this case the assumption is that the current actually traverses the earth.

A little reflection will show that both the ideas cannot be correct at one and the same time. Further, the analogy is defective in the first case, and none is given in the second. Yet they possess the merit of having satisfied all practical requirements, and there is no occasion to labour the point regarding their defects. Comment is made only for the purpose of indicating the position from a scientific point of view.

Cable telegraphy does not appear to have any special idea of its own, so presumably it relies on one of the ideas just mentioned.

Take now the case of telephony. Modern telephone practice makes use of metallic circuits for the reason that such lines, if properly erected, are free from the serious defects peculiar to single or earthed-circuit lines. This suggests that the earth connection has here a different effect from what it has in telegraphy, and this is due to the type of current used in telephony, and to the sensitivity of the telephone apparatus.

With the advent of radio-telegraphy, the function of the earth took on a new aspect, and the technical literature devoted specially to this subject, generally puts the case more or less in this way, viz.:—

The original open oscillator of Hertz did not employ the surface of the earth to form one plate of the circuit, his oscillator being of the linear or "dumb-bell" type. When, however, an earthed oscillator is employed as a radiator, the electrical properties become of great importance. It is then assumed that the depth to which the high-frequency currents penetrate into the substance of the ground is not very great, so that it is necessary to deal with the conductivity or other properties of the upper layers only. The effective resistance of the earth is, therefore, greater than that of an "earth return" for any low-frequency or direct-current system. Further, if the land contains iron ores or other magnetic material, the depth of penetration is enormously decreased, so that the effective resistance rises very largely.

It is pointed out that the actual function of the earth in the propagation of the waves is a much debated point, especially as regards the difference, if any, in the case of conductively earthed and balanced aerials. It is stated that it is not clear how much of the "guiding" effect, whereby waves are propagated round the curvature of the earth, is to be attributed to reflection from the upper layer of conducting air, and how much to the gliding action by which the bases of the waves are conceived to be attached to, and guided by, the conducting surface of the earth.

Now "earth current" telegraphy is practically the opposite of radio-telegraphy, so that the following explanation of this action forms a contrast. It was given in an article appearing in the Royal Engineers' *Journal* for January, 1920, by Capt. L. C. Carus-Wilson :—

"If an electric current is sent into the earth at one point and leaves it at another it travels from one point to another not in a straight line, but along a series of curved paths. If the two free ends of the two wires attached to a receiving instrument are inserted into the earth at some distance from each other, and not far from the earth current just mentioned, they will have a difference of potential, and a current will flow through the receiving instrument. If it is a telephone current which flows through the earth, and if the receiving instrument is a telephone, then in the latter may be heard the message picked up from the earth."

It will be seen that the several ideas which have been quoted are very dissimilar, and have a particular, rather than a general, bearing on the essential point at issue.

To complete the case it only remains to add that the principle of the experiments made by Major-Gen. Squier is stated to be the transmission of electric waves *not through* a conductor, but alongside it, *i.e.*, the waves are "guided" by the conductor.

Telegraph practice, both land and cable, is firmly established in its claim to regard the earth return as representing a path of zero resistance, since actual conductivity measurements on lines of varying lengths give results in such close agreement with this principle, as to amount to confirmation. These circuits, therefore, have all the appearance of behaving almost exactly similarly to circuits made up of two wires with one half of the resistance, and the electrical efficiency of the earth return method is in accord with this condition.

In telephone practice the case is complicated by the fact that the current is variable in frequency and amplitude, and is subject to distortion and alteration effects due to the particular electrical characteristics of the line, which are, themselves, not necessarily constant. As a measure of the efficiency of transmission in two-wire circuits telephone engineers use the standard cable equivalent, which is a cable having certain specified values of resistance, capacity, and inductance per mile. Thirty miles of this cable represents the limit of commercial speech. If one of the wires of a circuit of this type were removed and its place taken by an earth connection, the speech limit would most probably be reduced, certainly not increased, so that in this case there is a loss of efficiency consequent upon the use of an earth connection.

The sensitivity of the telephone receiver is such that it is much affected by extraneous currents, and so bad is this interference that for this reason alone, the earth is seldom used. On important circuits of any length careful "balancing" is necessary when two conductors are used, and this requirement often necessitates the transposition and revolving of the wires.

In the case of radio-telegraphy work, if it is taken that the ear can perceive a stream of energy of the order of 0.4×10^{-6} ergs per second, and assuming that the air wires collect the energy from a wave front of one square metre, the application of the inverse square law indicates that 2 watts should be audible on a flat earth at a distance of 3,200 kilometres. In practice it is found that something less than 20,000 times this, viz., 40 kilowatts can be heard at the distance mentioned under favourable conditions.

There are certain physical and economic factors which, by their influence, set limitations to the distance over which it is practicable to transmit telegraphic signals or telephone speech waves, and it will be useful to state briefly the position in this respect.

In land-line and cable telegraph working, the voltage which can be utilised without imposing an undue strain upon the insulation represents one limitation, and the effect of the line constants upon the speed of signalling represents the other.

Any further increase in voltage is of doubtful economy if this action renders necessary a more expensive insulation. The practical method of overcoming the difficulty is to install repeaters by means of which the total length of the line can be divided into a number of independent lengths, and the signals automatically repeated forward from section to section. This method also overcomes the difficulty of the line constants (principally the resistance and capacity) with regard to the maximum speed of signalling.

The importance of transmitting, unimpaired in form, the alternations originated by the sound waves impinging upon the microphone, is so great in telephone practice that, with the usual devices, the practical limit of distance is quickly reached, due to the distorting and attenuating effects of the resistance, inductance, and capacity of the circuit. To render it possible to communicate telephonically over distances comparing with those of telegraphy, a great deal of intricate research work has been necessary, and, although it is now possible to telephone across the American Continent—a distance of nearly 4,000 miles—this is only accomplished by means of two-wire circuits specially constructed, equipped with expensive apparatus, and most carefully maintained in good condition, at very great

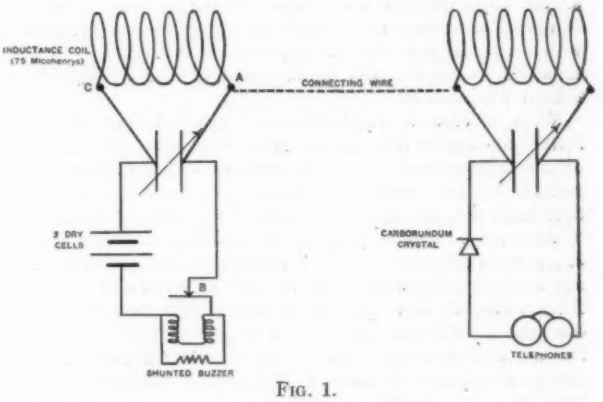

Fig. 1.

cost. The limitations of the line constants are overcome artificially, which means, simply stated, a substitution of less difficult limitations.

The constants per mile of a circuit in a cable are so much greater than those of an aerial line, that the limit of commercial speech over such a circuit is much less than is the case when using aerial wires, and there are, at present, difficulties in the way of applying the special devices used (for the purpose of improving the position) in the case of overhead lines. Not many years ago it was considered that the design of a microphone capable of standing a greater current without heating would help by making the initial amplitude greater, but this method, although quite practicable, does not afford an adequate solution, for the reason that the distortion factor remains, with the result that whilst the volume of the received sounds is greater, the words are indistinct, and therefore from a commercial speech point of view there is no gain.

In radio-telegraphy practice, the limitations are of a special type. The primary power at the transmitting station can be increased to a value of the order of several hundred kilowatts, and the energy transferred to the aerial in modern designs is considerable.

It is the case, however, that the limitations with regard to the actual propagation of the waves are a matter of much uncertainty, and there are many instances where equivalent transmitting plants differ greatly in

their effective range. The difficulties in this respect are considered to be due to the nature of the site, to the nature of the intervening earth, and to the electrical state of the atmosphere. Of these the last is particularly variable, and occasions wide variations in results. Despite the amount of observation work done with a view to establishing a mathematical formula to express the range of a station, the result has not been satisfactory. The formula as given is empirical, and the absorption factor which enters into it is decidedly speculative, even though it agrees with the results obtained in particular cases. The present use of amplifying devices at the receiving end, enables communication to be maintained under adverse conditions, but this is merely the principle of the relay similar to that adopted in the case of land-line and cable telegraph work. The same remarks apply to radio-telegraphy with the additional difficulty introduced by the use of a microphone.

A brief account will now be given of the experiments which tend to show how the limitations mentioned may be avoided, and the efficiency improved in land-line, cable, and radio working.

It was deduced, from a comprehensive series of controlled experiments, first, upon a conductive network earthed efficiently and permanently at one point only, and, secondly, upon a conductive network earthed at many points, that the earth connection principle requires modification in cases where alternating currents are concerned, and that the direction in which research work should proceed, was that of employing a single wire connecting the two sets of instruments independently of an earth connection.

Fig. 1 shows two oscillatory circuits, arranged as transmitter and receiver respectively, connected by a single wire. At the transmitting end it is essential that the connection be made at the particular point indicated, and the reason for this can be readily understood if it is borne in mind that the transmitting circuit must be left free to oscillate, and yet be able to part with a portion of its energy to the distant receiver. This requirement does not apply at the receiving end, but if the same instruments are used for sending and receiving, the arrangement should be identical in order to avoid the necessity of changing over. If the connecting wire is quite short—say, a few feet—then it will be found that the best signals are obtained when the capacity of the condenser in the particular design under review, is from 100 to 300 centimetres. With a capacity larger than this no reaction takes place. The instruments having been adjusted to give the best results, it will be found that the introduction of a high value of inductance in series with the connecting wire produces no diminution in the strength of the received current, and similarly with capacity. Resistance does not produce any effect until values of the order of tens of thousands of ohms are reached, and then the signal strength remains at a good audible value over a further considerable range.

Lengthening the distance between the two sets of instruments causes them to tune in the ordinary way, that is to say, the variable condenser of the transmitter may be increased by steps up to several thousands of centimetres, and the receiving condenser will tune sharply at the same values, the signals being of extraordinary intensity.

The connecting wire may be of small dimensions and indifferently insulated. The wire used was No. 36 S.W.G., single silk-covered, and a considerable surface of the wire was rendered bare in the length experimented upon, which was approximately one mile. Subsequently the insulation was soaked with water over a great part of its length. Messages in Morse code were transmitted from and received at both ends, using wave lengths from 300 to 1,000 metres, and the results were uniformly good under all conditions.

When the insulating covering of the wire was damp the signals were perceptibly increased in strength, but the tuning was unaffected.

Tests were then made to ascertain the effect of connecting to earth, and it was found that, with the wire directly on the surface of the ground under the conditions just mentioned, the connecting of the wire to small metal pegs driven into the ground did not impair the signal strength, and did not affect the tuning. Moreover, with the wire broken, and the break bridged by means of a porcelain cleat, the effect was to reduce the signal strength to approximately one-third of the normal value, but the signals were still readable with ease.

It was found, however, that if the wire makes contact with a mass of conducting material, such as a wire net or metal sheets, the experiments fail completely, irrespective of whether this conducting material is efficiently earthed or not.

For instance, on permitting the wire to touch a small building constructed of galvanised iron with very poor connection to the ground, the signals were inaudible. The position of the contact is immaterial; it can occur close up to either of the instruments, or at any point between, with the same effect. Similar results are obtained if the wire is immersed in water having an appreciable conductivity, and this can be confirmed by means of a small tank of salt water into which a loop of the wire, partially bare, is made to dip.

From the results the following conclusions appear to be justified:—

1. The earth connection is detrimental to alternating current work involving medium and high frequency (such as telephone work), and extremely so in cases where oscillatory conditions apply.

2. For the transmission of electric waves over considerable distances, the most efficient method is to connect to two points by a conductor of *limited dimensions*, and this conductor must not make contact *en route* with any considerable mass of conductive material.

Much, if not all, of the obscurity regarding the function of the earth in the transmission of electricity is thus disposed of, and it would appear to be justifiable to say that the earth acts as an electrically charged sphere. The intensity of this charge is variable according to time and locality, and it is derived partly from within and partly from without the surface.

The surface of the earth, taken as a whole, is equivalent to that of an imperfect conductor, but not so imperfect as to be regarded as an insulator. Portions which may be composed of material having practically the properties of an insulator, are given the appearance of being partially conductive by virtue of the resident charge, and also, in the case of alternating currents, by reason of the capacity.

Electric waves, formed and radiated from an aerial system, are at their inception so close to the charged surface of the earth, that they are subjected to a great degree of absorption as a result of that proximity.

These remarks are intended to be suggestive of the lines upon which further, rather than final, investigation can proceed.

It will eb observed that the suggestions made offer an adequate explanation of the better relative efficiency of the propagation of electric waves from airships, and the like; but it has to be borne in mind that even in this case, the waves are not free from the effects due to the existence of an electrostatic and electromagnetic field.

For the propagation of these waves over the surface of the earth, the single-wire method represents a way in which the limitations may be avoided, and it is clear that this also is the way in which the difficulties regarding the line constants, applicable to telephony, can be removed.

The small power used (two 1.5-volt dry-cells) in the experiments, and the simplicity of the apparatus, are points of contrast with what would be necessary, if an aerial-earth arrangement were employed, and the absence of amplifying devices is a special feature.

The Trade Slump.—According to the *Financial Times* a lack of foreign orders led to the discharge of 200 employés of Messrs. Marshall Sons & Co., at Gainsborough, last week-end.

EXTERNAL WASTING OF FUEL ECONOMISER PIPES.

By EDWARD INGHAM.

The principal cause of deterioration of fuel economisers of the Green type is probably external wasting of the vertical pipes. Such wasting often takes place rapidly, and unless remedied may eventually result in fracture and explosion.

Generally speaking, external wasting is caused by damp or moisture which is allowed to settle on the external surfaces of the pipes. The dampness may be brought about in several ways. For instance, the economiser may be placed in what is naturally a damp situation, with the result that the whole of the brickwork setting surrounding the economiser is more or less damp. It is well known that brickwork is porous and readily absorbs moisture, and hence if the setting is to remain dry, a damp situation must be avoided.

In some cases, the setting becomes damp through allowing waste water from valves, &c., or condensation from the small engine which drives the scraper gear, to soak into the brickwork.

Sometimes the soot chamber directly under the economiser is below the level of the drains, so that any water which is allowed to run into it cannot be drained off. Under such circumstances, the lower portions of the economiser will be constantly exposed to dampness, and to overcome the difficulty it will be advisable to dig a well near to the soot chamber, and provide a connection by means of which the water in the chamber can be carried off into the well. Arrangements will, of course, have to be made for emptying the well from time to time.

Another way in which the economiser becomes damp is by condensation of the steam contained in the furnace gases, and the damp arising from this source is the most usual cause of external corrosion of the vertical pipes. The tendency to set up corrosion from this source of damp is frequently very much aggravated by the fact that the coal used for firing the boilers contains much sulphur, in which case the waste gases passing through the economiser chamber will probably contain sulphur dioxide or sulphur tri-oxide. The latter, in combination with steam, are liable to form sulphurous and sulphuric acids, which are extremely corrosive, and which may reduce the thickness of the tubes to a serious extent in a short time.

It will be understood, therefore, that all possible precautions should be taken to guard against condensation of the steam contained in the furnace gases. The vertical pipes are, of course, at approximately the same temperature as that of the water contained in them. The lower this temperature is, the greater will be the tendency for the steam to condense on the external surfaces of the pipes. In the great majority of economisers, the water enters by a bottom branch pipe, and rises simultaneously up all the vertical pipes. In such, the water will be very much colder at the feed inlet end than at the other end of the economiser. Hence, the pipes at the feed inlet end are in most cases those most liable to suffer from external wasting due to condensation of steam in the furnace gases.

In some economisers, however, matters are so arranged that the water first enters the top of the first group of pipes, passes down to the bottom, and then rises up the remainder of the pipes. In such cases, the trouble will be usually met with near the tops of the first group of pipes, where the cold water enters.

Obviously the tendency for condensation and wasting to take place will be greater the lower the temperature of the entering feed. Experience appears to show that in most cases, wasting will not take place to any appreciable extent if the feed water is not allowed to enter the economiser at a lower temperature than 90 or 100 deg. F. Much, however, depends upon the prevailing conditions of working. Whilst in some cases no harmful effects result when the temperature is only 90 deg., in others, severe and rapid wasting occurs when the temperature is as high as 130 deg.

As already stated, much depends upon the conditions. If the economiser is set in a dry situation, and the gases contain little moisture, corrosion is not likely to occur with an inlet temperature of 90 deg. The worst conditions obtain in economisers which are set in a damp situation, and which work in connection with boilers fitted with steam jets for accelerating the draught, and in those which are heated by the gases from refuse destructors. In the former case, the steam jets add considerably to the steam naturally present in the furnace gases; in the latter case, not only do the gases contain a large quantity of moisture, but they also contain certain corrosive ingredients, and under such circumstances it is highly desirable that the temperature of the water entering the economiser should not be less than 130 deg. F.

When the feed is passed through a feed-water heater before going to the economiser, or when the condensed steam from a condensing engine is used as the feed the temperature of the water when it reaches the economiser will be in most cases so high that trouble from corrosion will not be experienced. In other cases, however, the water will be comparatively cold, and some means of raising its temperature the desired amount must then be resorted to. One method of doing this is to connect the delivery pipe of the economiser with the suction pipe of the feed pump, by means of small wrought-iron piping provided with a stop valve. In this manner, some of the heated water leaving the economiser may be mixed with the cold water passing to the feed pump. The stop valve referred to will enable

Fig. 1.

Fig. 2.

the engineer-in-charge to regulate the quantity of hot water passing into the cold feed, so as to raise the temperature of the latter to what is found by experience to be necessary for preventing condensation of the steam in the furnace gases.

Another method is to pump a small portion of the hot water leaving the economiser into the cold feed supply by means of a small inexpensive centrifugal pump. This method, of course, necessitates the coupling-up of the economiser outlets and inlets to the pump; also suitable provision for isolating the pump, and a convenient means of driving it.

A regulating valve must also be provided, so that the quantity of hot water pumped into the cold feed may be satisfactorily regulated. Although this method has found favour with some, it would certainly appear to be much less convenient and far more expensive than the one previously described; but the advantage of forcing the water through the pipes by the pump must not be overlooked.

Several devices have been introduced for raising the temperature of the feed water before it passes into the economiser. In one of these, which has been patented, a short pipe with a central branch and end flanges is inserted in the cold water feed range, the branch being coupled up to one end of the hot water return pipe. The other end of the latter pipe is connected to a branch on the top branch pipe of the economiser, either at the hot or the cold end, as may be most convenient. The

branch may be made parallel, or tapered, the taper being outwards towards the pipe body.

The short branch pipe is fitted with an internal tube expanded into the body of the pipe, and perforated with a number of holes of the required size.

Under working conditions, the cold feed, on its way to the economiser, passes along the short branch pipe, through the internal tube, whilst the hot water passes along the return pipe, enters the branch and the branch pipe so that some of it passes through the perforations and so mixes with the cold feed. The temperature of the latter is thus raised as required.

Other devices might be described, but as they are much the same in principle, we need not do more than refer to them. The exhaust steam from auxiliaries is generally used when available for this purpose.

It has been pointed out that external wasting of economiser pipes often takes place very rapidly, and that unless remedied, the wasting may, sooner or later, result in fracture and explosion.

It is therefore important that frequent examination of the external surfaces of the pipes should be made, particularly of those pipes where the cold water enters. Most of the pipes of a fuel economiser are, of course, inaccessible for external examination, but fortunately, the pipes most liable to suffer from external wasting are, as we have seen, those in the outer rows at the inlet end of the economiser, and these pipes are mostly accessible, so that the condition of the inner pipes is usually of secondary importance. The lower portions of the pipes are naturally the parts most affected, and generally the wasting will be found to be most severe a few inches from the bottom box.

The extent of the wasting can, as a rule, be best estimated by measuring carefully the external diameter of the pipe, and comparing this with the original diameter, which, in the standard Green economiser, is 4.56 in., the internal diameter being 3¾ in.

It is not wise to allow any pipe to become reduced by corrosion to a less diameter than 4.2 in., in view of the fact that a certain amount of internal corrosion may have taken place, whilst there is always the possibility to be considered that the pipe may have been cast eccentrically in the first instance, so that the metal at one part is thinner than it was intended to be (see fig. 1. The actual strength of the pipe can, of course, only be judged satisfactorily by determining the actual thickness of metal at the weakest place, but it is difficult to do this. In fact the thickness can only be determined with certainty by withdrawing the pipe and breaking it up. Fig. 2 will serve to illustrate how a pipe may become reduced both on the internal and the external surfaces, the blackened portion representing the actual thickness of metal remaining.

Where there is reason to believe that in addition to much external wasting, internal wasting has taken place, it may be advisable to withdraw a pipe and break it up, so that a good idea of the condition of the pipes adjoining may be obtained. Seriously reduced pipes should be replaced without delay, or if it is not practicable to do this, then the sections containing the defective pipes should be blanked off by means of sheet steel disks inserted at the joints of the branch pipe with the top and bottom boxes.

When, in spite of all efforts to cure the trouble, severe external wasting of the pipes at the feed inlet end continues, the question of installing a few extra rows of pipes, intended to take the bulk of the wear and tear, and so save the main economiser, may be worth consideration, but this will involve considerable trouble and expense in enlarging the economiser chamber, fitting the new pipes and connections, scrapers, and so on.

ELECTRIFICATION OF THE EBBW VALE COMPANY'S WORKS AND COLLIERIES.

By W. DIXON, M.I.M.E., M.I.E.E.

(Abstract of paper read at the Autumn Meeting of the Iron and Steel Institute *at Cardiff.)*

Amongst the works visited during the meeting were those of the Ebbw Vale Steel, Iron, & Coal Co., Ltd. To-day the properties either owned or under the company's control extend almost continuously over an area of 15 miles north and south and four miles east and west, so that the works are amongst the largest in the country. It is estimated that, with the completion of the schemes at present in progress, they will provide for an annual output of: Coal, 5,500,000 tons; coke, 575,000 tons; pig, 450,000 tons; while the allied industries embrace the manufacture of steel rails and sleepers, galvanised steel sheets, weldless steel tubes and couplings, coke-oven and blast-furnace by-products, iron and steel castings, and engineering work. Recent legislation promises to provide a supply of electrical energy throughout the country in general, and in South Wales there is thus an area of 60 to 100 sq. miles being dealt with already as—and by—an independent concern. The installation represents the development of the last 20 years, and to a great extent it exemplifies the development of the electrical industry in its relation to the iron, steel, and coal industries.

The following figures enable one to form an idea of the capacity of the plant installed in its relation to other local plant, the figures being taken from data compiled for the year 1917:—

	Plant Capacity.	Units Generated.
Cardiff Corporation ...	11,500 kw.	16 millions
Newport ,, ...	7,100 ,,	9¼ ,,
Swansea ,, ...	4,800 ,,	6¼ ,,
Llanelly ,, ...	3,300 ,,	5½ ,,
Total .	26,700 kw.	37½ millions
South Wales E. P. D. Co.	13,400 kw.	36 millions

With the Ebbw Vale Co. there is a continued and ever-increasing demand for power; at present the units generated per annum may be taken at 45 millions, which will probably be increased in the immediate future to 60 millions, and the generating steam plant installed may be taken at 22,000 kw.

The present site of the generating station is that of the original station, that site having been determined because from the first the utilisation of waste gases was counted upon. With all its developments, the efficiency of electrical machinery throughout the past decades has not materially altered or improved, the result being that little or no replacement has been either desirable or necessary, and, speaking generally, it is believed that there is no modern development which the company would either on technical or economical grounds be justified in adopting at the expense of existing plant. Incidentally it is of interest to record that the plant has been practically immune from accident or breakdown, and free from other than intermittent stoppage, except in the case of a fire at the generating station. There has been no fatal or even severe accident through electrical causes.

The electrical plant installed may be approximated as follows:—

Generating plant, combined output ...	22,000 kw.
Over 50 transformers ,, ,, ...	31,000 k.v.a.
Over 500 motors ,, ,, ...	30,000 h.p.
Converters ,, ,, ...	2,500 kw.

The principal power station (fig. 1) is situated at Victoria, and is equipped with four turbo-alternators, two of 2,000 kw. and two of 5,000 kw.; a third 5,000-kw. set is in process of completion. Steam alone is used for power generation, the gas-fired boilers being in close proximity to the generating station, and connected with the main battery of boilers which supplies the blast-furnace equipment. While at present some coal is used, it is estimated that, with the completion of the scheme at present in hand, there will be a margin of 10,000 to 14,000 h.p. available for electrical generating purposes, after the steam requirements of the blast-furnaces have been met. The alternating current is generated at 2,200 volts, three-phase, with a periodicity of 50, and the turbines are arranged for a steam pressure of 175 lb., with superheat. The condensing plant is arranged on the "Tinsley" system, being driven both electrically and by steam.

Direct current is generated at 275 volts from four high-speed engine sets of about 200 h.p. each, these sets comprise the original installation, and one mixed-pressure turbo-generator, having an output of 600 h.p. The station also contains motor generators for supplying energy in bulk to the Ebbw Vale Urban District Council, which utilises the energy for lighting and other purposes in the town of Ebbw Vale and its immediate area. The d.c. supply to the steelworks area is supplemented by motor and rotary converters to the extent of 2,500 kw.

The other power stations are situated at: Six-Bells Colliery, where the equipment consists of two 1,500-kw. mixed-pressure turbo-alternators, generating at 3,000 volts, 50 cycles, and feeding a line through South Griffin to the Upper Deep Collieries; Prince of Wales Colliery, Abercarn, where the equipment consists of three steam turbo-alternators, having a combined capacity of 3,500 kw., and generating at 2,000 volts, 50 cycles; and Cwmsychan Colliery, where the equipment consists of two combined engine-driven sets, generating at 25 cycles.

The installation roughly divides itself into two distributing systems. Fig. 1 indicates in outline the district dealt with to the north of the generating station, and comprises the whole of the iron and steel works sections. Fig. 2 indicates in outline the district situated to the south of the generating station concerned with the collieries. Direct current is taken to the steelworks from Victoria, and is transmitted on overhead cables to a distribution house in the steelworks. The alternating current is taken from the switchboard in the

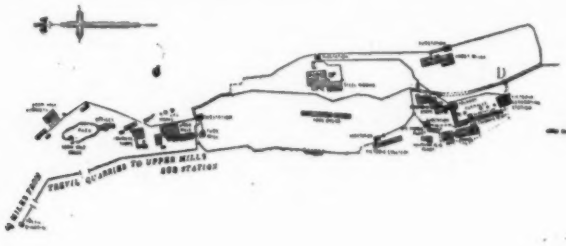

Fig. 1.—Ebbw Vale Steel Works Power Distribution System.

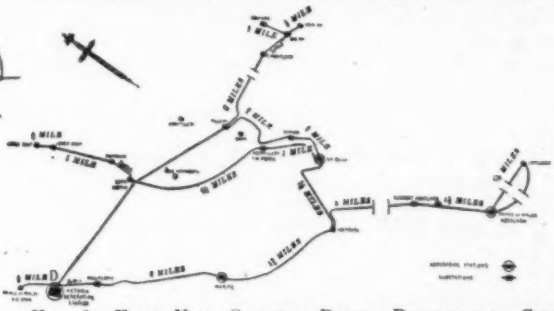

Fig. 2.—Ebbw Vale Colliery Power Distribution System.

generating station to the main sub-station at D, and is distributed to the northern area at 2,200 volts on a ring main with balanced protective gear.

From various sub-stations energy is delivered at full voltage, and at 500 to 550 volts for general purposes. A supply is also being arranged for Trevil Quarries, situated some four miles to the north of the Upper Mills, transmission being arranged at 6,600 volts. The sub-station D, besides providing for the above, is also utilised as a distributing point for the southern requirements as generally indicated in fig. 2. A ring main on the split-conductor system is being run from the distributing sub-station *via* Waunllwynd, Marine, Aberbeeg, Six-Bells, Vivian, Tillery, and South Griffin Collieries back to the sub-station, and the transmission is to be at 20,000 volts. From this ring branches will be fed to the collieries north of South Griffin, and also to the Cwmsychan group to the east of Tillery.

Certain collieries and works are connected with the generating station at the Six-Bells Colliery, the transmission being at 3,000 volts; this recently-acquired station is being connected with the main ring system. There is under consideration an extension of the transmission system between Aberbeeg to Cwmcarn *via* the Newport-Abercarn Collieries and the Prince of Wales Colliery at Abercarn. Meanwhile, however, there is no connection between Aberbeeg and Abercarn, although Abercarn and Cwmcarn are connected by a duplicate line, current being transmitted at 6,600 volts to the Cwmcarn Colliery, which is entirely electrified.

In the main, the transmission lines are erected on the overhead system, though in places it has been necessary to adopt underground cable. In the case of the steelworks, "H" poles of the ordinary type have chiefly been employed. For dealing with the collieries in the southern section, the lines embraced within the ring are fixed on poles, and are of a type suitable for dealing with the voltage concerned, viz., 20,000.

Fig. 3 shows the type of sub-station which has been adopted, and how provision is made for the incoming and outgoing supplies, the transformers and switchgear being arranged as shown.

Throughout the steelworks electrical power is used for the hundred-and-one usual purposes. The various departments dealt with in this area, commencing with the sub-station, are: Sheet mills, dolomite plant, steelworks, upper-mills, Ebbw Vale blast-furnaces, spring and wagon shops, tube works, coke ovens, Victoria Colliery by-product plant, gas-cleaning plant, engineering shops and foundry, and the Victoria blast-furnaces.

At the collieries electrical power is employed, amongst other purposes, for: Pumps, 3,200 h.p.; winders, 2,000 h.p.; ventilating fans, 1,300 h.p.; air compressors, 4,400 h.p., and continual additions are being made to each group; most of the collieries are arranged with their own sub-stations, it being ultimately intended to render it possible for the whole of the electrical requirements to be supplied from the main generating station at Victoria. Various considerations, however, come into the scheme, inasmuch as collieries have been acquired in which generating plant was already installed.

It is not necessary to deal with each colliery equipment, beyond mentioning the following: Prince of Wales (Victoria) Colliery has an electric winder with gear-driven alternating motor, electrically-driven air compressors, and an electrically-driven variable-speed mine fan. The Waunllwyd Colliery has an air-compressor installation, and the Six-Bells Colliery has a mixed-pressure turbo-generating plant and a sub-station dealing with 20,000, 3,000, 2,200, and 550 volts. The Abercarn (Prince of Wales) Colliery has a steam-driven turbo-generating plant, and Cwmcarn Colliery has an electrically-driven "Ilgner" winder, and an electrical equipment throughout (no steam-raising plant).

Electrically-driven air compressors are installed at the following collieries: Prince of Wales (Victoria), Waunllwyd, Marine, and Vivian; there are steam-driven compressors at various other collieries. With the probability of an extended use of compressed air for underground purposes, it is anticipated that a combination of compressors with a regulating set may secure a specially economical working condition in what, up to the present, is one of the most wasteful and inefficient sources of power.

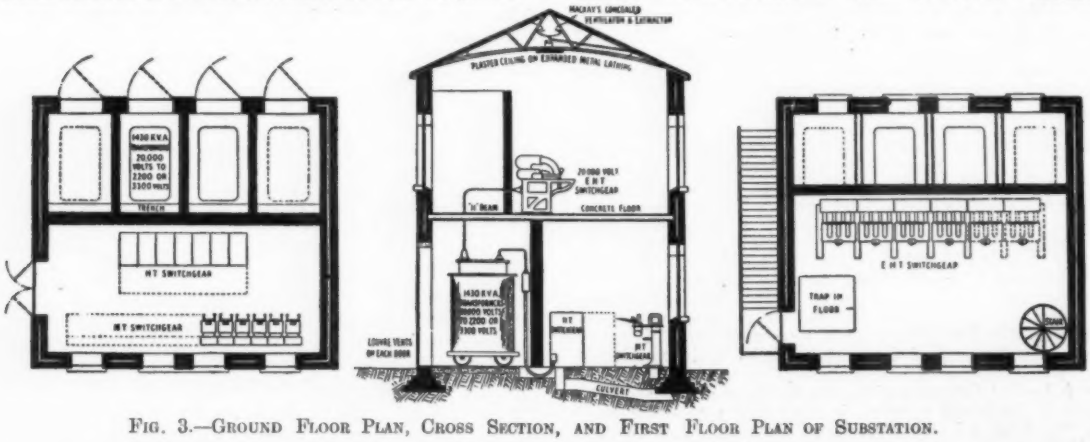

Fig. 3.—Ground Floor Plan, Cross Section, and First Floor Plan of Substation.

Worcester Electricity Works Appointments. — The management of the Worcester Corporation electricity works has found it necessary to reorganise the technical staff, and in consequence it is not now necessary to fill the position of chief assistant. The two vacancies for engineers-in-charge have been filled, but the matter of the appointment of improver assistants is still under consideration.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

New Electric Grill.

An electric grill having several novel features is being manufactured by Mr. H. W. Sullivan, 368 & 369, Winchester House, E.C. 2. It is of robust construction, being made of cast iron, and finished in black. The grid and runners are so designed that the grid may be raised or lowered during cooking without the necessity of drawing it out. Further, the top plate containing the elements is hinged, to open, as illustrated in fig. 1, thus allowing one to turn the food which is being grilled without exposing it to the outside atmosphere during the process of cooking. This latter device also greatly facilitates the keeping of the inside of the grill clean. The elements,

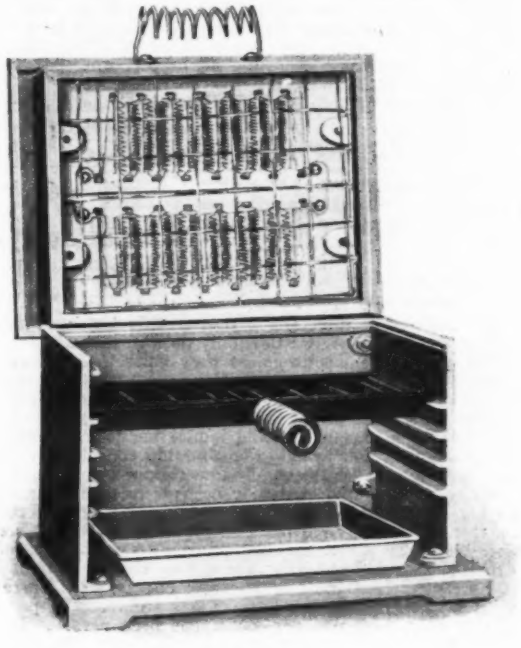

Fig. 1.—New Electric Grill.

two in number, are of 550 watts capacity; these are screwed to the underside of the top plate, in turn being protected by a suitable guard. Both the drip pan and grid provided are tinned. The terminals situated at the back of the upper portion are protected by a removable cover.

New Vernier Potentiometer.

To meet the demand for a long-range potentiometer without using a slide wire, Messrs. H. Tinsley & Co., Werndle Hall, South Norwood, S.E. 25, have brought out a new design of

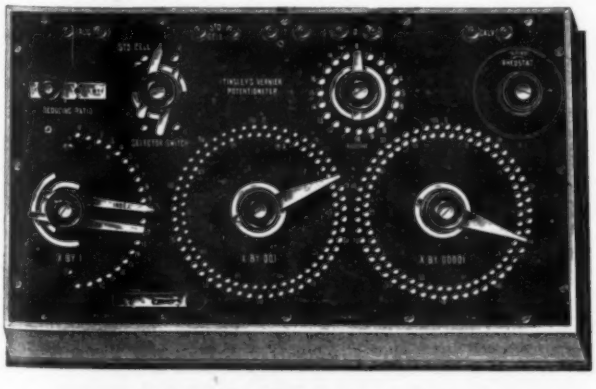

Fig. 2.—New Vernier Potentiometer.

vernier potentiometer (fig. 2). The normal range of this instrument is from .00001 to 1.90100 volt. The lower range records potentials from .000001 to .190100 volt. The principle adopted is that of the "Thomson-Varley" slide. The main dial consists of 20 coils of 10 ohms each, and the vernier dial of 100 coils or .2 ohm each. The fine adjustment dial is a series of 100 coils each of .001 ohm resistance, placed in series with the main dial. There are two rheostats, one for approximate adjustment of the standard current and the other for exact adjustment. The selector switch is a three-way D.P. switch, one pair of poles being allotted to the cadmium cell terminals, and two pairs to the circuits marked "1" and "2." The reducing ratio is an arrangement of a two-way plug switch, by means of which the current in the working coils of the potentiometer can be reduced to one-tenth of its normal value of .01 amp. This reduces the voltage drop on the measuring dials to one-tenth of the value shown. The working parts of the apparatus are mounted on a stout ebonite board, all contacts are of Post Office gold-silver alloy to avoid corrosion, and the instrument is mounted in a mahogany or teak case with a detachable lid.

Electro-vapour Radiators and Central Heating.

We have had brought to our notice particulars of an interesting electrical application which increases the field of electric heating. The arrangement is manufactured by Messrs. Benham & Sons, Ltd., 64 and 66, Wigmore Street, W., and consists of a special electric element (with two minor accessories) which is screwed into individual cast-iron sectional radiators in hot-water or steam central-heating systems.

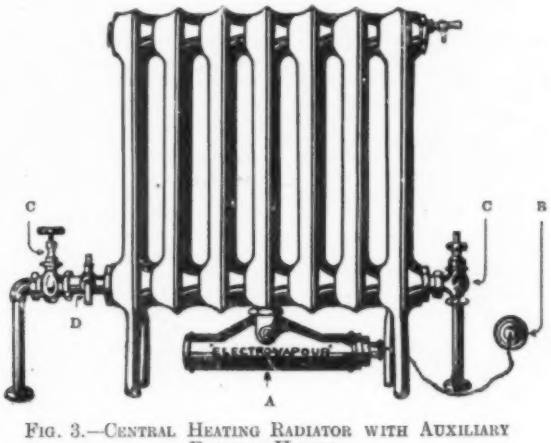

Fig. 3.—Central Heating Radiator with Auxiliary Electric Heater.

The arrangement is such that each method of heating is independent of the other, the heat being maintained either from the main furnace or electrically, according to circumstances. Such a combination enables rooms to be warmed at any time of the year when the main furnace is out of action.

Fig. 3 represents in elevation a cast-iron sectional radiator, being a single unit of a hot-water central-heating system. The electrical element and chamber, known as the "Electro-vapour" unit, is screwed by means of a special nipple into the base of the middle section of the radiator. An additional level-indicating tap is fitted between one valve and the radiator body. The illustration shows the element unit A at the bottom, the two isolating valves C, and a level-indicating tap D which can be placed either side of the radiator. The object of the two valves is to isolate the radiator from the remainder of the system, and the level-indicating tap allows the water to subside to the correct working level. B is a wall socket.

The electrical capacity of these elements ranges from 0.6 kw. to 2 kw., and in cases where large radiators are installed, it is sometimes necessary to have two-element units fitted.

The firm claims that several advantages are obtained by the use of these conversions. One of considerable importance is that the use of a large radiating surface with low-temperature transmission is ideal for economical heating, because there is practically no local heat to supply electrical energy for, this energy, so to speak, being saved. The number of watts allowed per cubic foot of air space for average conditions of ventilation appears to be a low figure, but in practice it is found to be sufficient.

The standard type of electro-vapour radiator (which is a self-contained apparatus, as described in our columns on previous occasions) is sometimes termed a "booster," because it supplies supplementary heat, if required.

"Electro-vapour" radiators are very suitable for this purpose, as the appearance of the two types of radiators is

identical, while the low temperature makes for economy. Thus a room which is at a temperature of 55 deg. F. can be rapidly brought to 60 deg. or more with a small electro-vapour radiator.

Economy is gained if the central system is designed to give a uniform temperature of 50 deg. F. over the whole building with small electric radiators to "top" the temperature to suit the individual taste.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Power Factor.

Recently my good friend Mr. E. W. Dorey has been foremost in attempting publicly to improve power factors. The cause of the prevailing deplorable condition is generally well known, and Mr. Turnbull's suggested juggling with a cheque book is hardly relevant, since we must have magnetism to produce rotary electric power.

I contend that we should levy a penalty upon those concerned—quite as unpleasant as the income tax. The basic cause of the situation will be found to be controlled by £ s d. When all the power engineers' pockets are affected by "cos ϕ," we shall be approaching a satisfactory solution. When the party who wants electric power finds that he or they have to pay heavily for K.V.A. and cheaply for KW.-hours, *i.e.*, a K.V.A. demand system plus a small figure for KW.-hours, then capital will be sunk in gearing, &c., and the purchase of high-speed cheap motors, pending the education of the whole power using and electrical brains of the universe concentrated on phase advancers and similar compromises. This subject could also advantageously be "side tracked" on to the question of increasing the voltage on consumers' premises.

Why not begin on all new consumers' power substations by doubling the declared pressure for power only, and thus relieve the high-pressure cable system at once? and consequently reduce installation expenses to the consumer. Prosecute and fine the Electricity Commissioners for every A.C. motor of less than 400 volts connected to any system after a certain date in prospect. Obviously I am writing from a low-voltage point of view.

Walter E. Rogers.

London, *September 19th*, 1920.

I note in your issue of September 17th your correspondent Mr. E. Freeman Smith very rightly condemns the use of the term "wattless current." The explanation of this term may be all very well as a mathematical device, but is very misleading as regards physical facts. This wattless current is always a source of great difficulty to students, as they are given to understand that there are two currents in the circuit, the power and the idle current, which is quite contrary to working theory, particularly as they are simultaneously flowing in opposite directions half the time. The best way of dealing with the circuit is to assume that there is only one current flowing in it, and to split up the E.M.F. into its two components at right angles to one another. We then have an applied E.M.F. leading the current, and it is resolved into one component in phase with the current and another 90 deg. ahead which is associated with surging energy and no power. "Wattless E.M.F.," therefore, seems a much better term to use than "wattless current." This "wattless E.M.F." in a circuit is taken up with coping with the self-induced E.M.F. which is associated with a magnetic field, which costs on the whole nothing in power. This magnetic field, without considering any wire which conducts it, takes in work on being formed, but gives it back when it dies away; the alternations of field causing a surging of energy out of and back into the electrical circuit, obviously no watts being expended when a complete cycle is considered.

I am aware that this is not an original way of looking at the question, but I think it is more straightforward than dealing with "wattless currents."

R. G. Vanneck.

Bristol. *September 19th*, 1920.

As Mr. Turnbull in his letter of the 14th inst. makes some statements which are rather misleading, I am compelled to reply, although I do not wish to lengthen this correspondence unduly.

Mr. Turnbull says that I have a very poor opinion of the utility of apparatus for the improvement of power factor, but I think it would do him good to read my article published in your journal of October 17th, 1919, and the three succeeding issues, when I think he will be satisfied that not only have I all along advocated the installation of condensers, but I may also claim to have had a fair amount of experience in the installation of such apparatus; it may interest Mr. Turnbull to know that the installation of such plant is part of my livelihood. Unfortunately, the subject of power factor has not received the consideration in this country that it merits, whereas in the States, condenser units up to 15,000 K.V.A. are in use, these, of course, being of the rotary condenser type.

Taking the hypothetical case referred to in previous correspondence in which the consumer's load of 4,000 K.V.A. is split up into energy component 3,000 KW. and wattless component 1,000 K.V.A., I maintain that unless the supply undertaking is badly laid out and badly managed, the whole of the 1,000 K.V.A. wattless does not go unpaid for, for the following reasons:—

When laying out a supply undertaking, the generating plant, sub-stations, mains, &c., are rated on an assumed overall power factor which, in the majority of cases, is taken as 80 per cent. Therefore, when the overall power factor of the supply is 80 per cent. the undertaking is operating under conditions for which it was designed. Logically, therefore, it follows that the supply undertaking in determining the rates for supply, whether they be on KW. demand basis or on a flat rate per unit, will have based the calculations on 80 per cent. power factor, *i.e.*, the plant rental portion of the rates assumes a power factor of 80 per cent. Under such conditions it follows that if a consumer is operating at 90 per cent. power factor his rate is higher than it ought to be, and he is helping to make up for the low power factor of other consumers, whereas a consumer operating at 70 per cent. power factor is getting it at a lower rate than he should.

In the case quoted above we have the following:—

Total load	4,000 K.V.A.
True energy component of load... ...	3,000 K.V.A.
Wattless component of load	1,000 K.V.A.
Supply undertaking rates cover 4,000 K.V.A. at 80 per cent. P.F., or wattless component of	800 K.V.A.
Difference, by which the supply undertaking are the losers	200 K.V.A.

My contention therefore is that in this instance not 1,000 K.V.A., but 200 K.V.A. wattless only goes unpaid for.

The above are conditions as they exist to-day, but these facts in no way detract from the desirability of instituting, where possible, the K.V.A. demand system of charge, as it follows that if the power factor of this load were raised to 95 per cent., the consumer would reduce his demand from 4,000 to 3,160 K.V.A., and would erduce his bill considerably, and at the same time assist the supply undertaking.

While on this subject it may perhaps interest your readers to know that in the case of two large supply undertakings in this country I have been successful in obtaining for the first time the K.V.A. maximum-demand rate in lieu of the existing KW. demand rate, the K.V.A. charge in both cases being 80 per cent. only of the KW. charge, *i.e.*, where previously 25s. per KW. per quarter was enforced, 80 per cent. of this only, viz., 20s. per K.V.A. has been agreed. In both cases, although at 80 per cent. power factor, the consumer would be no better or worse off, a static condenser is being installed for the improvement of power factor, to take full benefit of the K.V.A. demand system of charge.

I am sure it will be of interest to your readers if Mr. Turnbull will explain exactly why he considers the "wattless component" meter the best solution. Several years ago I made arrangements with a leading manufacturer of such meters to go one further, by making an integrating meter to integrate K.V.A.-hours, and fitted with a "Merz" maximum-demand dial to give K.V.A. demand over a time period (say, 20 minutes), the object of the meter being to get the demand only; the ordinary kilowatt-hour meter being employed for registering the energy; and many such meters are now in successful operation. I cannot see that the wattless component meter would serve any useful purpose whatever as compared with other more suitable meters which are on the market to-day, and I am anxious, therefore, to know why Mr. Turnbull considers the wattless component meter the best solution. In my letter of the 14th inst., I referred to the "Arno" meter, which would certainly appear to be very much superior.

I shall look forward with eagerness to Mr. Turnbull's promised third article, especially as he is to explain what "wattless" really is, but referring to analogies may I just give him a kindly word of advice as follows: "An analogy when good is very, very good, but when it is bad it is 'orrid."

E. W. Dorey.

Enfield. *September 27th*, 1920.

Single-phase Meters on Three-phase Systems.

Single-phase watt-meters are quite satisfactory on balanced three-phase loads. They are, however, not suitable on unbalanced systems. It is probable that the instrument referred to by "Stop Watch" was connected to such a circuit; hence the incorrect reading. The diagrams show four methods by which a single-phase watt-meter can be connected to a three-phase system. The most suitable arrangement will be determined by the nature of the other apparatus supplied by the same instrument transformers as the watt-meter. Where the current transformers are required for a protection system, the particular type of protection will decide whether they can

be connected delta or star. The potential transformers may serve power-factor indicator, reverse-current relay, synchroscope, or other apparatus which may not permit an arrangement such as that shown in fig. 2.

Fig. 1 shows an arrangement with an artificial neutral on the potential circuit. It should be noted that the three legs should have equal resistance. In the middle leg, the resistance

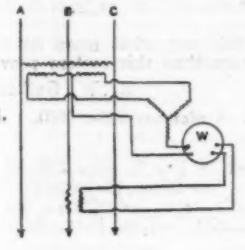

Fig. 1.

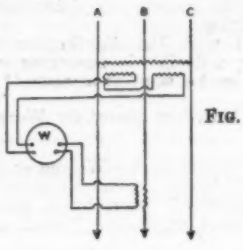

Fig. 2.

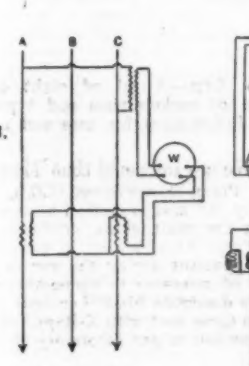

Fig. 3.

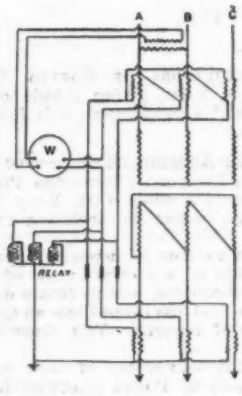

Fig. 4.

of the watt meter must be taken into account and allowed for. This is the arrangement referred to by Mr. J. Henderson.

Fig. 2.—This arrangement dispenses with the artificial neutral.

Fig. 3.—Only one potential transformer is required with this arrangement.

Fig. 4 shows the watt meter in the circulating-current circuit of a delta-star transformer protection system.

All the above give correct readings on balanced three-phase circuits, and at any power factor. Where the load is unbalanced, a polyphase watt meter should be used.

Thomas A. Robertson.

Glasgow.
September 27th, 1920.

The E.P.E.A. and the E.T.U.

I have read with interest the very pertinent remarks in your leaderette of September 17th, and the letter from "A Group of Senior Power Engineers."

There is no doubt that the E.P.E.A. fills a distinct need, and has done excellent and much needed work in the direction of raising the status of power station engineers with reference both to salaries and general conditions of service, which prior to its formation were in many instances lamentable. The Association was recognised by the best employés as serving a useful purpose, and it is unfortunate that its standing has been jeopardised by the injudicious action of its Executive.

The situation created by the Penistone strike and its threatened extension to power stations was obviously a very difficult one for the Association to deal with, and the original statement issued to the Press, that it intended to give its support to whichever of the parties showed tactics of a peaceable character, was obviously well intentioned.

Unfortunately, by making such a statement, the Association tacitly endorsed the attitude of the E.T.U. in extending the quarrel to electrical undertakings, which were hitherto entirely uninterested. The principle that the shutting-down of power stations can be utilised in any event as a means of influencing the settlement of a dispute in another industry is not admissible, and the suggestion was very rightly submitted to severe censure in your editorial comments. For an Association, which is intended to include responsible senior officials of electrical undertakings, the only possible attitude must surely be to express the strongest disapproval of any intention to use a public service in an industrial dispute simply because the unfortunate public is thereby perforce brought into the quarrel.

In the instance now under review, the matter was the more flagrant in that the threat was, in the first case, confined to London as the political nerve centre of the country. The E.T.U. did not even call out all its members in London, but only those engaged in power stations, and if the E.P.E.A. considered that this course was a peaceable one, the argument is, to say the least, difficult to follow. The E.T.U. has members working in key positions in almost every branch of industry in this country, and in these times when disputes in one industry or another occur almost daily, the acceptance of the principle that the interruption of an essential supply can be utilised at any time to bring pressure to bear to settle disputes is quite impossible for any nation governed on constitutional principles.

If the E.P.E.A. is to continue to number among its members the senior officials of supply undertakings it must take the earliest opportunity to make it quite clear that it intends to ensure the continuity of supply from the power stations which its members control, and to resist any attempt to interrupt that supply for a cause which does not directly affect its own vital interests.

Another Senior Power Engineer.

September 22nd, 1920.

Like others of your correspondents, I have been surprised at the extraordinary policy officially announced by the Executive of the E.P.E.A. as governing its action in any dispute in which it may become involved through the action of another union. This is that "the E.P.E.A. is not concerned with the merits of the dispute, nor with its origin."

Suppose the E.T.U. were to put forward a demand for all the surplus profits of the electricity supply industry to be divided amongst its members. (In view of the miners' recent demands this cannot lightly be dismissed as improbable.) The supply authorities would very naturally refuse, and it is equally likely that they would turn down any suggestion by the E.T.U. that the matter should go to arbitration. According to the official policy of the E.P.E.A., the latter would have to throw in its weight with the E.T.U., as it is not concerned with the merits of the dispute, but only with which side has refused arbitration.

Despite the sarcasm of "Another Power Engineer," I join with "A Group of Senior Power Engineers" in being unable to accept this policy. If acceptance is a condition of membership of the E.P.E.A., then I am afraid my resignation will have to go in.

If Mr. Jones's explanation of the policy offered to the "Group" had they signed their names contains nothing further than the circular letter issued to corresponding members, I am afraid it would not do much towards altering their views. Mr. Jones also tilts at members who have been absent from meetings. It would cost the writer over 20s. train fare, plus a night's hotel expenses to attend a section meeting, and unless such meeting were held on a Saturday it would also involve absence from work for part of an afternoon and morning. Were it not getting away from the original subject of this correspondence, I would be tempted to enlarge on this point of insufficient information to outlying groups of members, but I refrain out of consideration for your space.

I enclose my card as the usual guarantee of good faith, but beg to subscribe myself meantime,

G.

I have seldom seen such confused arguments as those appearing in the letters from "Se Defendendo" and "Another Power Engineer" published in your issue of September 24th. Both writers are apparently imbued with the idea that the members of the E.P.E.A. correspond with the three tailors of Tooley Street, who strutted up and down saying: "*We* are the people."

"Se Defendendo" and "Another Power Engineer" set up such a high standard of righteousness in championing the cause of the oppressed that one is very surprised to find them supporting the cowardly policy of hitting innocent onlookers (in the form of the general public), because the authors of this policy are unable to strike one set of opponents in a quarrel in which they are not involved.

The E.P.E.A. were not concerned in the Penistone dispute; and because the E.T.U. started to run amok there was no justification whatever for the E.P.E.A. to follow suit.

People who make such a claim (as the E.P.E.A. does), of obtaining justice for those who need it, should practise what they preach, and not perpetrate a gross injustice on the innocent, long-suffering public.

Of course, from their past record, one does not expect anything but selfishness from the E.T.U.; they are for themselves and themselves alone (nobody else counts a button); but one does expect something more from the E.P.E.A., whose members are men of education and scientific training. I prefer to think that the recent action of the E.P.E.A. is the result of "swelled head" on the part of the Executive, and is not endorsed by the majority of my brother engineers.

H. C. Silver.

London.
September 27th, 1920.

Domestic Supply Pressure and Wiring.

The thanks and appreciation of the electrical industry are due to Mr. Wordingham for his timely article on supply pressures and wiring.

Particularly striking is the last paragraph but one, in which he says: "It should surely not pass the wit of man to invent some less cumbrous scheme than piping." But is it necessary to invent any more systems of wiring? Surely we have too many.

It seems to me that we are passing through the same mill in wiring systems as we did in cable systems.

We have at last a satisfactory and more or less standard cable system, namely, paper lead armoured, laid direct. Subject to local conditions, no engineer thinks of laying any other nowadays.

Screwed barrel seems to be the favourite system of wiring, but why are we wedded to one so cumbrous and expensive?

What is the matter with the cab tire sheathed system of wiring for all pressures and situations (except perhaps extreme dry heat)? That it requires so few I.E.E. rules should be sufficiently convincing as to its safety and efficiency.

With the usual disclaimer, I can honestly say that after 14 years' experience with most systems of wiring, I think the C.T.S. has the least objections of the lot.

No wiring system is yet perfect—the C.T.S. has certain objections which will be overcome; I think the tough rubber protection should be slightly thicker—but for house wiring (new and old) I feel sure there is nothing better. The price of the wire is high, but I find the cost of installing is low.

A lot of prejudice has to be overcome before C.T.S. is adopted, because we have become so obsessed with the idea that an electric wire must be in a pipe, but as it becomes better known the piping habit will die out, at least for house wiring.

I wish Mr. Wordingham would say what more he wants for a flexible house-wiring system than this system provides. Does he want it armoured?

B. W. Gothard.

Aldershot Electricity Works. *September 25th*, 1920.

[Correction.—We regret that in line 9, page 394, of Mr. W. Arthur Jones's letter in our last issue, the words "small majority" were by a printer's error substituted for the correct expression, "small minority."—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—J. J. Symons (Zodiac Peerless Electric Lamp Co.), 25, Denmark Street, Charing Cross, W.C.—Trustee (Mr. A. H. Partridge, 3, Warwick Court, Gray's Inn, W.C.), appointed September 18th.

J. Jagger (Jagger & Co.), electrical engineers, Halifax.—The public examination in bankruptcy of this debtor took place at Halifax County Court on September 24th. The liabilities were £1,359 gross; expected to rank for dividend, £1,303; assets were estimated to produce £626, less preferential claims of £55, making a deficiency of £732. The debtor alleged that the causes of his failure included losses arising from defective work done by incompetent workmen, who, in addition, limited their output. He was originally a brassfounders' apprentice, served three years with the Forces during the war, had only seven months' practical experience in the electrical trade before commencing business, but had acquired some theoretical knowledge through correspondence classes. The Official Receiver suggested that the debtor's incompetency had been a contributing factor of the cause of his insolvency, but the debtor demurred to this. The examination was closed.

H. Turner, electrician, 31, St. Paul's Road, Southsea.—First meeting October 6th, at the Official Receiver's Office, Portsmouth. Public examination, November 1st, at the Court House, Portsmouth.

Company Liquidations.—Variable Pumps and Motors, Ltd.—Winding up voluntarily. Liquidator, Mr. M. Lancaster, 46, Basinghall Street, E.C. A meeting of creditors was called for September 30th.

Electric and General Works, Ltd.—A meeting is called for October 6th, at 54, Rue la Boetie, Paris, to hear an account of the winding-up from the liquidator, Mr. F. H. Christlieb.

W. A. & R. J. Jacobs, Ltd.—Winding up voluntarily. Liquidator, Mr. R. G. Sidford, 20, John Street, Adelphi, W.C. Meeting of creditors, October 4th, at the Institute of Secretaries, 59A, London Wall, E.C. Particulars of claims to be sent to the liquidator by October 31st.

British and Overseas Engineering Syndicate, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Findlay, 4, Old Burlington Street, W. 1. Meeting of creditors, October 5th.

Lowa Engineering Co., Ltd.—Voluntary liquidation. Meeting of creditors, October 4th, at 25, College Hill, Cannon Street, E.C. Liquidator, Mr. A. J. Harmer.

Hydro-Electric Concessions, Ltd.—Meeting of members, October 4th, at 3-4, Great Winchester Street, E.C., to hear an account of the winding up from the liquidator, Mr. W. Gain.

Dissolutions of Partnership.—Wood & Roberts, electrical engineers, 7, Salem Street, Oldham.—Messrs. H. R. Wood and D. A. Roberts have dissolved partnership. Mr. Roberts, who will continue the business in his name, will attend to debts.

Imlay & Bland, coach builders, motor, electric and general engineers, London Road, Oadby, Leicester.—Messrs. G. A. and W. Imlay and E. Bland have dissolved partnership. Debts will be attended to by Messrs. G. A. Imlay and W. Bland.

Catalogues and Lists.—Messrs. F. J. Shenton & Co., Ltd., 68 and 69, Shoe Lane, E.C. 4.—An illustrated and priced leaflet dealing with "Supreme" electric irons, kettles and boilers.

Messrs. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, W. 8.—A card-leaflet outline of a typical Siemens Leclanché cell, containing a description of the porous pot form.

Messrs. Higgs Bros., Sand Pits, Birmingham.—"Monthly Magazine," Vol. II, No. 7, October, 1920 (24 pp.). Stock list of A.C. and D.C. motors, notes on current consumption of motors, &c.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Pamphlet No. 16 C, "Peebles Alternating-Current Motors (Polyphase Induction Type)" (20 pp.). A very complete description of medium-sized, self-contained motors, with clear illustrations of details in their construction, including rotor winding and short-circuiting and brush-lifting gear. Dimensions and weights are given in both English and metric systems.

Accumulators of Woking, Ltd.—A set of eight cards 10 in. × 8 in., giving details of various sizes and types of "Hellova" accumulators, with instructions for care and maintenance.

Trade Announcements.—We are informed that Messrs. X-Rays, Ltd., of 11, Torrington Place, Gower Street, W.C. 1, have purchased the whole of the X-ray and electro-medical business of the High-Tension Co., including the plant, stock, goodwill, and patents. Mr. Mortimer A. Codd, who is well-known in connection with his work on high-tension apparatus during the war and his authorship of a standard work of reference in connection with these instruments, will in future dissociate himself entirely from business, and has entered into an agreement with X-Rays, Ltd., as director of research. This places his unique laboratory at their service.

For the convenience of their customers, the principal sales department of Pope's Electric Lamp Co., Ltd., on and after October 4th, will be at 5, Arthur Street, London, W.C. 2, instead of at the works at Hythe Road, Willesden. Large stocks of "Elasta" lamps will be held at Arthur Street (Mr. E. A. Marx, sales manager). Telephone number: "Gerrard 6074" (two lines). Telegraphic address: "Duramentum, Westcent, London."

Mr. A. R. Macey has resigned his position as manager to Haslam & Stretton, Ltd., Bristol Depôt, and will shortly be commencing business on his own account as a factor and agent. He desires to receive manufacturers' lists and catalogues at Victoria Terrace, Clifton, Bristol.

Messrs. Perrin's, Ltd., of 15, Catherine Street, London, W.C. 2, have recently secured sole British and Colonial selling rights for the A. S. Skandinaviske Kabel og Gummifabriker of Christiania, who, as announced in our pages, have recently secured large contracts for cable for the Norwegian Government, for the Dutch Indies, &c. Messrs. Perrin's have also completely acquired the interests of the Indestructible Cable Co., formerly of 20, High Holborn, and regular supplies of "Indestructible" insulated wires and cables are now available.

Lead.—In their report dated September 25th Messrs. G. Cawson & Co. state:—

> Lead is still arriving from Germany, and with the continued low value of the mark, further shipments will no doubt be forthcoming. We understand arrangements have been made permitting smelters there to export 50 per cent. of their production.
>
> Spanish arrivals are likely to continue on a good scale—as France having now a surplus stock of lead, shipments originally intended for that country will no doubt be diverted to the United Kingdom. Many of the mines are now increasing their output, and some of the very old brands are again making an appearance on the market. Inquiries from the home trade continue poor, while the demand for export remains exceedingly quiet. The recent strike at the electrical works has, no doubt, interfered with consumption, and consumers who had deliveries of immediate lead postponed are probably covered for some weeks.

Messrs. James Forster & Co., in their statement, say:—

> Consumers have not been buying to any extent, but many want lead, and in the event of the settlement of the miners' dispute, there should be considerable buying for early delivery, in which case there is not too much about, as is indicated by premiums of 20s. to £3. having been paid for spot stuff this week.

Social Events.—Over 100 traffic department members of Blackpool Electricity and Tramway Works went for an outing—the first since the war—on September 22nd. The party went in four motor char-a-bancs to Chester.

The bowling handicap between Blackpool Corporation electricity and tramway employés was concluded on September 23rd. The final players were:—L. Winckley, 21; T. Carradus, 10. There were originally 64 entries.

Copper Prices.—Messrs. F. Smith & Co., report, September 28th:—Electrolytic bars, £116, £2 decrease; do. sheets, no change; electrolytic wire rods, £132, £2 decrease; do. H.C. wire, ½d. to ¾d., ½d. decrease; silicium bronze wire, no change.

Messrs. James & Shakespeare report, September 29th: Copper bars (best selected), sheets and rods, no change; English pig lead, £37, (10s. decrease on last week's quotations.)

New French Company.—A new company has lately been formed in Paris (2, Avenue Velasquez) with a capital of 3,500,000 fr., and the title La Société l'Equipment Electrique.

Lalley Light.—We regret that through an accident at the printers, the words "32 volt" were omitted from the electrical specification in the advertisement appearing on page 56 (Sup.) of our last issue.

Book Notices.—"The Decimal Educator." Vol. II, No. 9. London: The Decimal Association (30 pp), price 6d. The September number of the magazine contains an admirable portrait of Mr. Harold Cox, whose studies of economics have made him a convinced supporter of the decimal system of coinage. Other features of the issue, in addition to an abstract of the annual report of the Executive Committee of the Decimal Association, are articles on "The Failure of the Penny," by Mr. Harry Allcock; "The Teaching of Decimals," by Mr. J. W. Ladner; "Methods of Illustrating the Metric System," and "The War and the Decimal System," by Major G. Plaisant, of the French Army Engineering Corps.

The Export Register of the Federation of British Industries. London: F.B.I. and Industrial Publicity Service, Ltd. 20s. to members, and 25s. to non-members (unless they are members of affiliated associations). This is a useful and businesslike volume, in which the F.B.I. and its purposes are described, and particulars of members and their products are classified. A good deal of information is given relating to the Overseas Organisation of the Federation, with which our trade readers are already familiar, and no doubt the publication will considerably help in developing the export trade of manufacturers whose particulars (including the addresses of their overseas agents and branches) are given. We understand that editions are being produced in French, Spanish and Portuguese for distribution in Europe and Central and South America.

From Newton to Einstein. By Benjamin Harrow, Ph.D. London: Constable & Co., Ltd. Price 2s. 6d. This very readable little book outlines the work of Newton, "the greatest genius that ever existed" (Lagrange), on gravitation and optics; the electromagnetic theory of light; and the nature of matter. It then describes the predictions of Einstein, which were in great part verified by the British Eclipse Expedition of 1919, which proved that light was deflected in accordance with Einstein's law of gravitation. The author points out that Newton has not been proved to be wholly wrong; but Einstein's law, developed in the light of present-day knowledge, is "more universal" than Newton's, and really includes the latter. He then explains the principle of relativity with the aid of analogies, so far as it can be explained without the use of mathematics. Numerous references are given to publications in which the interested reader can pursue the subject to any degree desired.

"The Motor Transport Year-Book and Directory." Vol. 5, 1920 (489 pp.). London: Electrical Press, Ltd. 20s. net.—This volume includes the new rates of taxation for road vehicles and some notes on the Ministry of Transport and its work, as well as reports of committees on traffic, fuel, &c. The publication forms a very complete directory of transport, &c., companies and officials.

"Dorman Wave-Power Tools." (68 pp.) W. H. Dorman & Co., Stafford.—This is a publication explaining the underlying principles of the transmission of power by the medium of wave impulses through water. The system is applicable to rock drills, riveting hammers and machines, coal-cutting machines, &c. The booklet is well detailed and clearly illustrated.

Journal of the American Institute of Electrical Engineers. Vol. XXXIX No. 9. September, 1920. New York: The Institute. Price $1.

"Industrial Electric Vehicles and Trucks." By W. Worby Beaumont. Pp. xii. + 194; 177 figs. London: Chas. Griffin and Co., Ltd. Price 15s.

Inquiry from India.—The Department of Overseas Trade has been advised by the representative of an Indian house that the firm are buyers of a large variety of lines of electrical machinery, plant and apparatus. The Department will furnish the name, also the name and address of the London agent, to British firms on application.

Deed of Assignment.—J. C. Raine, A. Podmore, and S. Hewitt (Hewitt, Raine & Co.), electrical engineers, 41, Lewis Grove, Lewisham, S.E. Particulars of claims to be sent by October 11th to the trustee, Mr. W. A. J. Osborne (Corfield and Cripwell), Balfour House, Finsbury Pavement, E.C.

E. W. Heath (Heath, Wingfield & Co.), 6, Hans Road, Brompton Road, S.W.—Claims by October 11th to the trustee, Mr. W. A. J. Osborne (Corfield & Cripwell), Balfour House, Finsbury Pavement, E.C.

Electrical Supplies in South Africa.—The *S.A. Mining and Engineering Journal* for August 28th states:—

> Materials in very fair quantity are arriving from Britain and the Continent. A leading dealer has just received a large consignment of lamp shades from Holland at prices ranging from 18s. to 20s. dozen; home price, as against British quotations of from 30s. to 48s., which is only another way of saying that the Continental workers seem to be facing labour troubles, &c., more heroically than their British *confrères*. At the moment there are no big contracts on hand, but, notwithstanding, a fairly good volume of business is being done locally, and even along the coast as far afield as Port Shepstone, &c. . . . The large shipments of material arriving, and still on the way, are bound very shortly to lower existing prices.

The Italian Metalworkers' Dispute.—The *Tribuna* reports that the engineers at the Pirelli works have decided to strike until the extremists who caused disturbances in the factory have been punished.—*Reuter.*

Malicious Destruction.—Two boys charged with malicious mischief at Paisley, at various works, destroyed over 200 electric globes, valued at £43.

Aerial Beanfeast.—From Messrs. Macdonald, Syer and Co., Ltd., of Gray's Inn Road, W.C. 1, we have received an excellent photograph as a memento of the first aerial beanfeast held by an electrical firm—their own, which we illustrated in these pages a short time ago.

Telegraph and Telephone Instruments for Latvia.—The Department of Overseas Trade states that the Purchasing Commission of the Republic of Latvia desires to purchase the following goods in this country. Quotations f.o.b. British port, and payment will be made in cash. Particulars as to quantities, &c., may be obtained at the offices of the Commission at 4, Draper's Gardens, Throgmorton Avenue, London, E.C. 2. (Telephone, Bank 5348):—

Materials and spare parts for radio-telegraph stations.

Telegraph and telephone spare parts:—(*a*) Telegraph apparatus: Morse, and various spare parts and essentials for same; (*b*) "Jusa" telegraph apparatus, and various spare parts and essentials for same; (*c*) field telephones and indoor telephones; (*d*) various special instruments (or tools) for effecting repairs to telegraphs and telephones.

Italian Companies.—Under the style of Manifattura Luigi Duca has been formed at Busto Arsizio a company with a capital of 100,000 lire, for the conduct of an electro-mechanical works.

The Società Anonima Termoelettrica has been embodied at Ferrara, with a capital of 600,000 lire, to trade in heating and lighting appliances.

An amalgamation of concerns is represented by the Società Anonima Industrie Riunite Passamanterie Venegoni, De Capitani e Successori Menni, which has been established at Milan (Via Pavia 5), with a capital of 6,000,000 lire, for the manufacturirg of telegraph and telephone cables, &c.

The Società Italiana C. A. has been constituted at Milan (Via Sansovina 1), with a capital of 100,000 lire, in order to work the patents of the late firm of Grouvélle & Arguembourg, for lighting and heating installations.

With a capital of 1,500,000 lire, the Società Padana di Elettricità has been formed at Milan, for the manufacture, purchase, sale, and working of electric plants.

The construction of aqueducts for hydro-electric undertakings and public works is the business of the Società Anonima Ingg. Vismara e Sala, formed at Milan with a capital of 500,000 lire.

There has been launched at Rome the Società Anonima Italia, with a capital of 100,000 lire, for the supply of electrical material.

Livio Suppo e Ca. have formed themselves into a company at Turin, with a capital of 50,000 lire, for the manufacture of electrical requirements.

At Milan has been constituted the Società Elettrotecnica Ing. Soldati, Pott. Pastore e Ca., with a capital of 400,000 lire, for the manufacture of electrical material and plant, &c.

B.T.H. Fittings.—On account of the rapid growth of their lighting business, the British Thomson-Houston Co. decided some months ago to extend their Rugby fittings factory. The new workshops are now nearing completion; the most efficient and up-to-date machinery is being installed, and the company hope very shortly to be able to manufacture and deliver fittings and reflectors in vastly greater quantities than heretofore. One of the staple products of this factory is the Mazdalux metal reflector for industrial lighting. It is expected that the extended facilities which will soon be available, will enable the B.T.H. Co. to treble or quadruple their Mazdalux output. In the case of "Eye-Rest" indirect fittings, semi-direct fittings, and other lighting equipment made in the B.T.H. factory, the production will also be considerably increased.

For Sale.—Doncaster Borough Council Electricity Department is prepared to receive offers for three 50-kw., and one 150-kw. Mather & Platt steam-driven generators. A three-throw pump and some Hopkinson valves are offered for sale by the Watford Electricity Works. For particulars see our advertisement pages to day.

Bauxite Mining in Germany.—As is known, various works for the production of aluminium were established in Germany during the war, with the encouragement of the Government. Raw materials were scarce during this period, and are only now obtainable at high prices owing to exchange considerations. The principal source of the supply of bauxite in Germany is located in Upper Hessen, where the deposits reach a thickness of from 1 to 8 metres, mining being mostly carried on in the open. Prejudice against the use of bauxite from this district existed for a long time, and even at present the distrust has not entirely disappeared. Nevertheless the conditions have become substantially better. Extensive explorations made on behalf of a Government department in Upper Hessen are said to have revealed the presence of deposits of alumina of a considerably greater extent than had formerly been assumed to be the case, and fresh deposits are still being opened up. The production of the mines and the number of mines have increased in recent years, and the industry is claimed to be a factor of importance for the district.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods connected with the electrical trades and industries:—

Semco, No. 402,947, Class 13.—Electrical ignition sparking plugs. Semco Co., Ltd., 19-20, High Street, Shoreditch, E. April 14th, 1920.

B.B.L. (lettering combined with design), No. 400,226, Class 18.—Electric welding apparatus, &c. Brown Bros., Ltd., Great Eastern Street, London, E.C. January 30th, 1920.

P.E.H. (lettering combined with design), No. 400,759, Class 18.—Electrical heating apparatus. Premier Electric Heaters, Ltd., 260, Bradford Street, Birmingham. February 14th, 1920.

Pyrotip, No. 406,110.—Electric apparatus in Class 8. British Thomson-Houston Co., Ltd., 83, Cannon Street, London, E.C. July 15th, 1920.

Siddor, No. 405,525, Class 18.—Electric stoves and heaters. Chas. H. Roddis, 66, Elstow Road, Bedford. June 25th, 1920.

Ferolite, No. 403,116, Class 13.—Electrodes of ordinary metal for electric lamps, &c. Ferolite, Ltd., 2, Kertling Street, Battersea, S.W. April 19th, 1920.

Aurolite, No. 405,040, Class 8.—Electrically-illuminated advertising apparatus. Aurolite Electrical Supplies, Ltd., Cromwell House, Surrey Street, Strand, London, W. June 10th, 1920.

C.C.C. Co. (lettering combined with design), No. 405,403, Class 8.—Rubber-insulated electric cables. No. 405,404, Class 8.—Paper-insulated electric cables. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. June 22nd, 1920.

Star (lettering combined with design), No. 399,474, Class 11.—Electric vibrators, being instruments used for curative purposes or in relation to health. Fitzgerald Manufacturing Co., Torrington, Conn., U.S.A. January 13th, 1920.

Electricity Costs.—A very satisfactory start has been made with the Federation of British Industries' scheme for the interchange between manufacturers of data regarding electricity costs and kindred subjects. Up to the present 50 members have supplied data. The first table of comparative costs was circulated at the end of July to members concerned, and as further returns were received it was decided to issue a supplementary list at the end of September. Members who have already supplied information will receive the supplementary lists as they appear from time to time.

Any other manufacturers who wish to take advantage of the scheme, by which mutual interchange of electricity cost per unit is effected, should immediately inform head office and forward data covering their electricity supply cost. The method to be followed in compiling information was outlined in *The Bulletin* of July 26th. It is felt that this method is not thoroughly satisfactory, but the majority of the opinions received show that the classification adopted is regarded as being the most effective. For interchange purposes what is required is the actual cost per unit. This can be quickly found by dividing the total cost by the number of units consumed. It has, however, been felt desirable to add a further specification, namely, the average number of hours per day during which current is used. The form of the return therefore is now as follows: Grade. Cost per unit. Average daily hours of load.

The Engineering Dispute.—London Companies' Protest.—At the time of the recent threatened electricity strike the Conference of Chief Officials of the London electric supply companies wrote to the London secretary of the Electrical Trades Union protesting at the manner in which the companies had been drawn into a dispute in which they had no concern or influence, and calling attention to the following matters:—

1. The companies had no dispute with their own men.
2. The action of the union in attempting to bind the members without the formality of a ballot was unconstitutional.
3. The companies declined to accept strike notices given by the union or shop stewards on behalf of the members, and would only recognise notices given by the individual employés.
4. Certain of the companies had received no notice of any kind of the proposed strike, while others had received less than seven days' notice.
5. Under Award 2,772 seven days' notice of termination of engagement of shift workers was agreed to be given on either side.
6. The letter received by some of the companies from the union referred to "a mass meeting of shop stewards representing all men employed," whereas some of the shop stewards in at least one company received no notice of the meeting in question.

On Thursday last week the conference of officials sent a further letter asking for some guarantee that the action of which it complained would not be repeated. The letter added: "I am also desired to intimate that all the companies must insist upon individual notices to terminate employment, and that they cannot accept any such notice from any official of your union or from the shop steward. I am also desired to ask you to place on record that this conference strongly deprecates the action of your union in attempting to coerce your members employed in the companies' undertakings in London to give notice to leave their work, in the hope that the public inconvenience, loss, and danger occasioned by your action would force a decision in favour of your union in a conflict in which they were engaged in another part of the country."—*Daily Telegraph.*

The *Sheffield Daily Telegraph* states that official correspondence clearly shows that Mr. Matthews, secretary of the Sheffield District Committee, acted without the consent of his Executive Council in writing to the Sheffield and District Engineering Employers' Federation to the effect that the District Committee supported the men on strike at Penistone in their effort to establish the right to claim all foremen as members.

The Executive Council points out that in coming to an agreement with the employers through the Industrial Council the words: "It was also agreed that the E.T.U., having intimated to this Council that they are prepared to withdraw the question of principle arising out of the Penistone dispute," refer only to the words in the Sheffield District Committee's letter, which were: "Further, to establish the right to claim all foremen as members."

The Executive says: "As the Executive Council had never made any claim, it had nothing to withdraw," which in effect, is a complete repudiation of the action of the Sheffield Committee and its secretary, Mr. Matthews.

German Engineering Industry.—At the annual meeting of the Union of German Mechanical Engineering Works (Verein Deutscher Maschinenbauanstalten) Generaldirektor Becker, of Köln-Kalk, said that a year ago orders from abroad were received in such numbers that the German engineering industry, after a long period of slackness, was able once more to provide its establishments with sufficient work. During the execution of the orders, however, great difficulties arose owing to the extraordinary rise in the cost of production, brought about by the increased cost of raw materials, the higher wages, and greater general expenses, while the value of the mark continued to fall steadily. Many works found themselves in a serious situation from which they could only partly escape by coming to agreements with their foreign customers. Many, moreover, were obliged to agree to the cancellation of foreign orders.

Meanwhile, the fall in prices has prevented the German industry from resuming competition with foreign industries, while wages have again had to be increased owing to the higher cost of living. The result is that foreign purchasers of German machines are still holding back, and that the former extensive sale territories are quite cut off for the time being. In the neutral countries buyers have fully covered their requirements during and since the war. East and south-east Europe scarcely count as purchasing countries owing to the unsettled political conditions. Italy, France, and Belgium are able to meet their own requirements, their engineering industries having developed greatly during the war. As for Great Britain and America, there can hardly be any question of supplying them with machines, for they are both competing with great success in the world's markets, where they have acquired great influence through financial investments.

If Germany is to regain her foreign markets, continued Herr Becker, there must be a reduction in the price of raw materials, the constant rises in wages must be avoided, and the working capacity of the shops, which has now sunk so low, must be increased. Moreover, the immediate abolition of export duties must be demanded.

Since March, when the value of the mark began to rise, the number of foreign orders received has considerably declined, and in some cases has completely ceased, while home business is quite at a standstill. These circumstances have led to important reductions in working hours, to dismissals of employés, and to the closing down of some concerns. If unemployment has not yet become manifest to any very great extent it is owing to the fact that a great number of works have been engaged on long-dated orders received before the crisis, and that other establishments have avoided reducing their staffs by building machines for stock. To-day enormous stocks of machines worth many millions of marks have accumulated, without hope of any considerable sales. In these circumstances manufacturers must be prepared for great losses, for the banks are no longer inclined to provide financial means for keeping works going on such a basis. There is thus danger in the near future of a great increase in the number of dismissals and further closing down of works.

Herr Becker considers that, in view of the fact that a further rise in the cost of raw materials and a fresh fall in the value of the mark are to be feared, the conclusion of foreign contracts in future will only be possible by the establishment of a sliding scale of prices, but admits that this system will mean yet another hindrance to German export business.

The reasons for the bad state of the home market are ascribed by Herr Becker to the fact that during the war many industries increased their establishments and are no longer in a position to find a sufficient amount of work for them. Whole works have consequently been closed down, and the machinery has been sold abroad. There are many obstacles to any increase in the plants of the various industries, and Herr Becker considers that it is erroneous to think that

the holding back on the part of purchasers is due to a kind of "buyers' strike." The truth is much more likely to be that many are not in a position to make outlays even for urgent requirements.

In conclusion, Herr Becker said that the German engineering industry must endeavour to avoid the great waste of labour involved in the extraordinary variety of working schedules in most works and in the diversity of types manufactured. To this end greater co-operation within the industry will be needed, leading in some cases to amalgamation of interests. It will also be necessary to standardise parts of which great numbers are required. This has been done successfully by the machine tool section, and it is hoped that the example will be followed by other branches of the engineering industry.—*Reuter's Trade Service* (Berlin).

Norwegian Association of Supply Works.—The annual conference of the Association of Norwegian Electricity Works has just been held at Christiania, 75 representatives being present. It was decided to appoint a committee to examine the question of establishing a buying office for the requirements of the associated works and submit a scheme for this purpose. Approval was also given to a standard form of contract for the supply of machinery, which is said to have also been accepted by the Association of Manufacturers. Herr Lichtenstein, of the Siemens-Schuckert Works, Berlin, presented a paper on high-tension cables.

Engineering Wages in Australia.—The Australian section of the Amalgamated Society of Engineers has submitted a claim to employers for considerable increases in wages and a 40-hour working week. The principal claims include: Blacksmiths, £7 13s. a week; angle iron smith, £7 19s.; brass polisher, £7 10s.; coppersmith, £7 16s.; driller or screwer, £6 18s.; draughtsman, £8 14s.; electrical welder, £9; furnaceman, iron or brass, £7 10s.; furnaceman, electrical, £9; furnacemen's assistant, £6 16s. 6d.; forgers and/or faggoters, £8 14s.; fitters, £7 10s.; general labourers, £6 6s.; ironworker, £7 10s.; motor mechanic, £7 10s.; motor attendant, £7 4s.; plumber, £7 10s.; pipe fitter, £7 10s.; switchboard attendant, £7 4s.; patternmaker, £7 19s.; shift engineer or shift electrician, £8 14s.; tinsmith, £7 10s.; turner, roll, £9 6s.; tradesmen's helpers, £6 13s. 6d. Leading hands are asking for 15s. a week extra; when in charge of 12 or more employés, 24s. extra. Casual employés not employed for more than one week demand to be paid 33⅓ per cent. over minimum rates; if not employed more than two weeks, 20 per cent. extra; and if not employed more than three weeks, 15 per cent. extra. Special extra rates are claimed for outside districts in New South Wales, Queensland, Tasmania, South Australia, and Western Australia. One apprentice to every four fully-paid journeymen is proposed. Employers are asked to provide for apprentices attending technical schools for eight hours a week (to be paid for at current rates).—*Commonwealth Engineer.*

The Dutch East Indies.—The Swedish commercial attaché at Batavia, reporting on the trade situation in the Dutch East Indies in the second quarter of 1920, states that great development is taking place in the use of electricity, which it is suggested should be followed by Swedish electrical firms.

Neuhausen Aluminium.—A Zurich report states that the Aluminium Industry Co., of Neuhausen, is in negotiation with a financial group for the sale of the company's works at Chippis, in the Valais canton.

Credit and Prices.—We reproduce the following interesting comment on this important subject from the City Editor's notes in the *Times*: "The cut in prices announced by two motor-car companies gives a further indication, if any were needed, that the existing volume of buying power is unable to support the present level of prices. Mr. Edward Berkeley, a member of the Council of the National Union of Manufacturers, writes to inquire how restrictions of credit or buying power are going to reduce prices. The answer is partly by compelling the liquidation of unsold goods, since, if a holder of commodities is unable to obtain fresh credit, he must provide himself with working capital by converting stocks into cash. A year ago 36 fr. 62½ cents of French currency would buy £1 of goods; now it would require 51 fr. 82½ cents to buy the same quantity of goods, if the sterling price of the goods had remained the same, which it has not. Similarly, other Continental currencies have lost a great part of their former purchasing power. The buying power of Italian currency, in exchange alone, is only one-half what it was a year ago, and that of German less than one-half. It is true that additional francs, lire, and marks have meanwhile been put into circulation, but not to an extent to offset this decrease in exchange value. This heavy decrease in buying power is not confined to the Continent; it extends to other markets in the East and elsewhere. How, in face of it, can prices do anything but fall, if demand is to revive? High costs of production will tend to prevent prices from falling rapidly, but they will not stop them falling. If costs of production are not reduced, then the pressure on prices will come *via* unemployment. It is obvious that, apart from monetary deflation, an increasing production of commodities must be reflected in an altered relation between supply and demand. The price of an article is determined ultimately by what a buyer is prepared to give for it; other factors, such as costs of production, must adjust themselves to that price. Apparently Mr. Berkeley thinks that, if the coming winter should bring about extensive unemployment, a fresh dose of inflation should be administered to the economic patient; but he wisely refrains from explaining how a deliberate aggravation of a disease is going to remedy it."

The Siamese Market.—Mr. W. L. Grut, Swedish General-Consul in Siam, is reported to have been able to secure the introduction of certain Swedish industrial manufactures in that country, in his private industrial capacity as managing director of the Bangkok municipal electricity works and tramways, head of a motor-boat shipyard, chairman of the directors of a cement factory, &c. Among the manufactures are mentioned turbines, electrical products of different kinds, pumps, Drott engines, ball-bearings, &c.

LIGHTING AND POWER NOTES.

Argentina.—Electric Lighting Scheme.—The Department of Overseas Trade states that a notice in the *Boletin Oficial* promulgates a Decree approving the scheme formulated by the National Sanitation Works Board, which includes the provision of electric lighting in the city of La Banda (Santiago del Estero).

Ayrshire.—Harbour Plant.—The Ayrshire Dockyard Co. is to erect an electric power station at Irvine Harbour. The building will contain converters, dynamos, and air-compressing plant for operating pneumatic machinery in connection with ship repairing, &c. The estimated cost is £1,200.

Barnes.—Extensions Sanctioned.—The Council has received sanction to install a 1,500-kw. turbo-alternator and necessary accessories. The amounts sanctioned for the carrying out of the work are £7,451 for buildings and £45,624 for plant and foundations.

Bingley.—Arbitration on Failures.—The Urban District Council has decided to give the Keighley Corporation notice of its decision to refer the question of the repeated failures of the supply of electricity from Keighley to arbitration, and that Mr. Thomas Roles, the Bradford city electrical engineer, be suggested as the arbitrator to be appointed under the particular clause in the agreement.

Birmingham.—Restrictions.—The Electricity Supply Department announces that owing to difficulty experienced in maintaining full supplies, some measure of restriction on use will be necessary until the winter months, with their heavy demands on the department's machinery, are over. In several directions supplies have already been curtailed, and to avoid the possibility of serious breakdown, further measures may have to be taken from time to time. It is apparent that the new generating station at Nechells, which would now have been in operation but for unavoidable delays in the erection of the structure and in its equipment, will not be ready for use for a considerable time. Apart, however, from this delay, it is reported that portions of the existing plant have failed owing to excessive loads.

Bo'ness.—Bulk Supply.—The Town Council is to ask the lessees of the electricity works (the National Electric Construction Co., London), to obtain from the Scottish Central Power Co. a contract for a supply of electricity in bulk, to be approved of by the Council. The burgh has spent £49,000 on the works since they were erected 20 years ago, and rather than find capital to the extent of £40,000 for new plant to meet the increased demand, it has decided upon a bulk supply, involving the erection of a high-pressure supply line, probably overhead, from the power company's existing nearest point of supply to the Bo'ness power station. The alterations at the Bo'ness station will involve an expenditure of £12,000.

Bradford.—Incorporation Scheme.—In connection with the incorporation scheme of the Corporation, a meeting was held of the Guiseley District Council (one of the towns involved), and a deputation from the Bradford City Council promised that, at an early date, should the ratepayers of the town consent to inclusion, an electric supply would be granted by the Corporation.

Bedford.—Water-Power Plant.—Sir John Anderson has harnessed the waters of the Ouse for the purpose of supplying electricity to his estate, about 10 miles from Bedford. The plant consists of a 56-B.H.P. vertical turbine coupled to two 19-kw. generators.

Bristol.—Year's Working.—The report on the working of the electricity department for the year ended March 31st last shows that the total income from all sources amounted to £229,525, as against £169,313 for 1918-19. The working expenses totalled £166,590, compared with £122,227, leaving a gross profit of £62,935, against £47,086. Capital charges reduced this surplus to a net profit of £10,875. Last year's result was a net deficit of £3,417. The total units sold increased from 26,269,745 to 29,039,680.

Bury.—Year's Working.—The total revenue for the year ended March 31st last was £77,430 and working expenses £58,364, leaving a gross profit of £19,066. The net result, after payment of all capital charges, was a surplus of £2,377, comparing favourably with the previous year's deficit of £1,983. The number of units generated rose from 13,388,384 to 15,367,885 and the average price obtained per unit from 9·5d. to 1·19d.

Additional Loan.—The contracts for the extensions at the electricity works having exceeded by £8,929 the amount previously sanctioned, it has been decided to apply to the Electricity Commissioners for permission to borrow this extra sum.

Continental.—France. — The Conseil Municipal of Paris has voted a credit of 77,500,000 fr. to the Compagnie Parisienne de Distribution d'Electricité to carry out its programme of complementary installations equal to 60,000 kw.; and a credit of 20,000,000 fr. to the Métropolitain railway for the proposed new lines: Place Gambetta to the Porte Saint Gervais, the Trocadéro to the Rue de Varize, and Les Invalides to the Rue du Four.

Italy.—The plans for the hydro-electric development of the Upper Adige contemplate the erection of three large generating stations. The first will be situated between Glurns and Chladerns, and will yield 50,000 h.p.; the second will be situated at Castelbello, and will provide 60,000 h.p.; and the third, which will be the largest, will furnish 100,000 h.p., making a total of 210,000 h.p. derived from the upper course of the Adige. Proposals to convert three lakes in the neighbourhood into impounding reservoirs have been given up, as likely to prove disastrous to three rural communes.

Spain.—A large electric undertaking in connection with the utilisation of the River Duero Falls appears at last to be taking definite form. A few years ago the Bank of Bilbao, with a group of capitalists, undertook to exploit these Falls, which are capable of supplying up to 1,000,000 h.p. The first plan provided for the utilisation of 300,000 h.p., which would enable the concern to supply an extensive region with light and power and possibly to electrify various railway lines over a distance of several hundred kilometres. Many serious difficulties, however, intervened to delay the realisation of the project. These have now apparently all been overcome, and it is hoped that before long the Bank of Bilbao and its associates will be in a position to commence the equipment of the Falls. The initial capital required for the undertaking is 150 million pesetas, and it is understood that this amount is already in view.—*Reuter's Trade Service* (Madrid)

Darlington.—Extensions.—The Electricity Committee has accepted a tender for the new plant to be installed at the electricity works. Authority has been received for a loan for the extension of the works as well as for the purchase of the plant.

Dover.—Year's Working.—The accounts for the year ended March 31st last, record a total revenue of £30,892. Against this, working expenses amounted to £23,072, leaving a gross surplus of £7,820. Capital charges amounted to £15,067, making the net result a deficit of £6,247, which, with the debtor balance from last account, makes a total of £13,371.

Electricity Districts.—The Electricity Commissioners give notice that the undermentioned areas have been provisionally determined to constitute separate electricity districts for the purposes of the Electricity (Supply) Act, 1919:—

North-East Midlands.—So much of the County of Derby as is included in the Municipal Boroughs of Buxton and Chesterfield; the Urban Districts of Bakewell, Baslow and Bubnell, Bolsover, Bonsall, Brampton and Walton, Clay Cross, Dronfield, Matlock, Matlock Bath and Scarthin Nick, North Darley, South Darley, and Whittington and Newbold; the Rural Districts of Bakewell, Blackwell, Chapel-en-le-Frith, Chesterfield, Clown and Norton.

So much of the County of Lincoln (Lindsey) as is included in the Urban Districts of Barton-upon-Humber, Brigg, Broughton, Crowle, Gainsborough, Roxby-cum-Risby, Scunthorpe and Frodingham, and Winterton; the Rural Districts of Gainsborough and Isle of Axholme, and the Parishes of Appleby, Aulkborough, Bonby, Bottesford, Brumby Rural, Burringham, Burton-upon-Stather, Cadney-cum-Housan, Cleatham, Elsham, East Butterwick, Flixborough, Gunhouse, Hibaldston, Holm, Horkstow, Kirton-in-Lindsey, Manton, Messingham, Newstead, Raventhorpe, Redbourne, Saxby, Scawby-with-Sturton, South Ferraby, Twigmore, West Halton, Whitton, Winteringham, Worlaby and Wrawby, in the Rural District of Glanford Brigg.

So much of the County of Nottingham as is included in the Municipal Borough of East Retford; the Urban District of Worksop; the Rural Districts of Blyth and Cuckney, East Retford and Misterton.

So much of the West Riding of the County of York as is included in the City and County Borough of Sheffield; the County Borough of Rotherham; the Municipal Borough of Doncaster; the Urban Districts of Adwick-le-Street, Bentley-with-Arksey, Bolton-upon-Dearne, Greasborough, Handsworth, Hoyland Nether, Mexborough, Rawmarsh, Stocksbridge, Swinton, Thurnscoe, Tickhill and Wath-upon-Dearne; the Rural Districts of Doncaster, Kiveton Park, Thorne, Rotherham and Wortley.

South-West Midlands.—So much of the County of Salop as is included in the Municipal Boroughs of Bishop's Castle and Ludlow; the Rural Districts of Burford, Cleobury Mortimer, Ludlow and Teme, and the Parishes of Bishop's Castle (Rural), Clun, Clunbury, Clungunford, Edgton, Hopesay, Hopton Castle, Lydbury North, and Mainstone in the Rural District of Clun.

So much of the County of Stafford as is included in the County Borough of Smethwick; the Urban District of Rowley Regis.

So much of the County of Warwick as is included in the City and County Borough of Birmingham; the Municipal Borough of Sutton Coldfield; the Rural Districts of Atherstone, Meriden, Solihull and Tamworth.

So much of the County of Worcester as is included in the City and County Borough of Worcester; the County Borough of Dudley; the Municipal Boroughs of Bewdley, Droitwich, Evesham, Kidderminster and Stourbridge; the Urban Districts of Bromsgrove, Lyle and Wolescote, Malvern, North Bromsgrove, Oldbury, Redditch and Stourport; the Rural Districts of Bromsgrove, Droitwich, Evesham, Feckenham, Halesowen, Kidderminster, Martley, Pershore, Rock, and Tenbury, and the Parishes of Berrow, Birtsmorton, Bushley, Castlemorton, Croome D'Abitot, Earls Croome, Guarlford, Hanley Castle, Hill Croome, Holdfast, Kempsey, Little Malvern, Longdon, Madresfield, Newland, Powick, Queenhill, Ripple, Severn Stoke, Upton-upon-Severn, and Welland in the Rural District of Upton-upon-Severn.

Notice is further given that the Commissioners intend to hold local inquiries into the existing organisations for the supply of electricity in the above districts. Notice of the dates on which the proposed inquiries are to be held will be issued at a later date. Objections or representations may be made not later than January 31st, 1921.

Time Extensions.—The date for the receipt of objections, &c., regarding the Commissioners' definition of the London and Home Counties and the South-East Lancashire electricity districts has been put forward to March 31st, 1921.

Eston.—Electric Lighting Order.—The Electricity Commissioners announce that the Urban District Council has applied for a special order authorising it to provide and distribute electrical energy within its district. Any objections respecting the applications must reach the Commissioners on or before October 23rd next.

Exeter.—Extensions Approved.—Approval has been given by the Electricity Commissioners to the extension of electrical plant at Exeter, and steps have been taken to obtain tenders for a steam turbo-alternator and condenser. The tender of Messrs. Metropolitan-Vickers, Ltd., has been accepted for a 1,500-kw. plant at £18,750, subject to the receipt of sanction to borrow the money.

Falkirk.—Supply Scheme.—The creation of a central source of electricity supply to meet the requirements of Falkirk, Stirling, Grangemouth, Bo'ness, Denny, Alloa, Bathgate, and Linlithgow, was discussed at a conference on Thursday last week. The representatives are to report to their respective Councils, and another meeting will be held.

Extensions.—The Electricity Commissioners have consented to the extension by the Corporation of the existing generating station by the installation of one 1,500-kw. turbo-alternator and accessory plant.

Gellygaer.—Loan.—The Urban District Council has applied for a loan of £2,000 to form a working balance for the electric light undertaking.

Inverness.—Electricity Survey.—With a view to ascertaining the suitability or otherwise of Inverness as an area for electricity supply for a district extending to Invergordon and Tain in the north, and to Nairn and Elgin in the east, the Town Council has instructed Mr. Hogarth, electrical engineer, Edinburgh, to make a preliminary survey of the area between Tain and Elgin, and to report upon the possibility of water power from Kilmorack and adjacent lochs.

London.—Hammersmith.—The Borough Council has received the sanction of the Electricity Commissioners to the extension of the electricity generating plant by the purchase of a 2,000-kw. turbo-alternator from the Liverpool Corporation.

Morley.—Bulk Supply.—The Council has arranged for a bulk supply from Leeds Corporation; 150 kw. is to be available, and a minimum charge of £500 per annum has been fixed.

New Zealand.—Hydro-Electric Power.—At a conference of hydro-electric power boards, held a short time ago, the Hon. J. G. Coates (Minister for Public Works), said that electric power boards would constitute a most important link in the hydro-electric development of the Dominion. The financial importance of hydro-electric developments might be judged from the estimate given in Mr. Parry's report of £7,000,000 for the North Island system, which at present prices would run to over £10,000,000. The South Island schemes would cost as much again, so that developments immediately in view would place the outlay on hydro-electric power on a footing with that of the railways and telegraph systems of the Dominion. An expenditure approximately equal in amount was required to distribute the power to various consumers throughout the country. That work would be the function of the electric power boards. The country distribution was essentially the function of a local authority especially elected for the purpose, and having jurisdiction over a large area, and it was with that object that electric power boards had been set up. Already that legislation had fully justified itself. Nine districts had been gazetted under the Act. Half the present coal consumption in New Zealand would be directly replaceable by electric power. At least one-half the kerosene and benzine now imported would also be replaced by a fairly complete supply of hydro-electric power, and there would also be a saving of firewood. It was estimated that the annual saving available upon the present fuel consumption would be as follows:—Coal, £3,000,000; firewood, £250,0[illegible]

mineral oils, £56,000; total, £3,810,000. With a normal extension of industries during the next five years there was a large number of uses to which electric power would be put, resulting in a gross saving to the public of double that amount.—*Auckland Weekly News.*

Pontefract.—Overhead Mains.—The Rural District Council has consented to the Yorkshire Power Co. using overhead lines for the supply of electricity to Glass Houghton and Ferrybridge, and has asked the company if it can arrange the lines so as to supply the houses to be erected at Airedale.

Rochdale.—Cost of Mains.—The Ministry of Health having declined to allow any part of the cost of laying electricity mains for the new Spotland houses to be charged to the housing scheme, the Housing Committee has decided to ask the Association of Municipal Corporations to take up the matter by bringing pressure to bear upon the Ministry to allow some portion of the expense to be charged to the scheme. In the Committee's opinion, £1,000 ought to be contributed towards the cost of laying the electricity mains.

South Africa.—Cape Town.—The Town Council proposes to invite tenders for a reinforced concrete jetty and pump house in connection with the provision of circulating water equipment for the Dock Road power station. The estimated cost of the scheme, together with the pipes, pumps and machinery, is £30,000.

Wellingborough.—Inefficient Supply.—The Northamptonshire Chamber of Commerce, at the instance of local manufacturers, has made representations to the Northampton Electric Supply Co. regarding frequent interruptions of supply alleged by consumers.

TRAMWAY AND RAILWAY NOTES.

Continental.—Germany.—Work has been recommenced on Berlin's new underground railway, the North-South line. The construction of the railway was begun before the war, but was suspended, and for the last six years portions of the Friedrichstrasse have been partially blocked by wooden fencing marking the scene of the excavations. The cost was estimated before the war at 82 million marks, but the figure now given is 400 million marks. The North-South will be Berlin's first completely underground line, as the present "Underground" is for a considerable distance an open-air overhead railway. It is not expected that the line will be completed before 1923.—*Morning Post.*

The town of Rüdesheim, on the Rhine, has acquired for 280,000 marks the Niederwald Railway, which has been closed for 33 years, and intends to electrify it. At the end of 1919 the value of the railway was booked at 1,588,371 marks. The company had a capital of 1,200,000 marks.—*Economic Review.*

France.—Begun in 1914, to tap the anthracite field of La Mure, the narrow-gauge electric railway from Grenoble to Gap was stopped by the war. Parliament having voted 6,000,000 fr. this year for the continuance of the work, the construction and equipment are being continued, but will need two years for full completion. The plans comprise the harnessing of the falls of the Port-du-Loup, on the Upper Drac River, and the building of eight electric automotors, one of which was supplied before the war, as a specimen, by the Thomson-Houston Co. Meanwhile a goods service is to be worked by steam on a section of the line.

Sweden.—The Stockholm Tramway Co. has decided to order about 50 new cars of considerable size, capable of carrying 60 to 70 passengers.—*Reuter's Trade Service* (Stockholm).

Glasgow.—Increased Charges.—The Corporation has increased the charges payable by engineering and shipbuilding firms in respect of material conveyed on the Corporation tramways from Govan station to their respective works.

Halifax.—Track Renewal.—The Tramways Committee has decided that as soon as possible the tramway track to Stainland shall be relaid. Difficulty has been experienced in getting rails, and the shortage of cement has also been a contributory factor in the delay.

Highland Railway.—Projected Electrification.—The announcement is made of the intention to electrify the Highland railway. The transition from steam to electricity as the motive power, it is stated, can easily be made. The standard gauge will be used, and the rolling stock can readily be adapted for electrical haulage.

Lancaster.—Accident.—A serious tramway accident occurred on September 27th to a workmen's car from Bowerham, on the Park route, which has, near the Park Hotel, a gradient of 1 in 10. The car stopped at the Board of Trade danger signal, fixed after a fatality in 1914, but on restarting the driver lost control. Gaining impetus, the double-decked car dashed forward to the junction with the Scotforth route, and there jumped the rails. A man on the footway did not heed an alarm, and was caught by the car and had both legs severed. The heavy vehicle crashed into the palisading in front of Springfield School, where the motor was knocked off and the forepart of the car wrecked. Several passengers were injured, and the driver had to be taken home in an ambulance. Eye-witnesses said he made frantic efforts to stop the runaway car, but his magnetic brake failed to act. This is the third accident on this route under similar circumstances.

London.—Reduced Services.—Seventeen trains in each direction will be cancelled on the electrified portion of the North London Railway between Broad Street and Richmond on Sundays, beginning on October 10th.—*The Times.*

Hammersmith.—The Borough Council is urging the following proposals upon the Minister of Transport:—That, in view of the fact that many travellers waiting in queues for workmen's tickets prior to 7.30 a.m. are often unable to reach the ticket-office before that hour, and consequently have to pay ordinary rates, extra facilities should be provided for the issue of workmen's tickets, either by increasing the booking staff, issuing workmen's tickets overnight, or issuing weekly books of workmen's tickets; that facilities should be afforded for through workmen's tickets to be issued from Stamford Brook to stations on the Piccadilly Railway; that ordinary return tickets should be available on the Piccadilly Railway, as it is felt that such a course would tend to lessen the congestion at the booking offices during the morning rush hours; and that through tickets should be issued for continued use on the tramway undertakings of the Combine and the Underground Railways.

Newcastle.—Strike Settled.—In order to force inspectors and time-keepers to join the Vehicle Workers' Union, the Corporation tramway employés ceased work on September 21st, but after three days' stoppage, agreed to refer the matter to the executive committees of their Union and the Managers' and Foremens' Association, returning to work on September 23rd.

Rawmarsh.—Increased Fares.—With respect to the Mexborough and Swinton Tramways Committee's application to the Ministry of Transport for increased fares, which was opposed by the Rawmarsh, Swinton and Mexborough Councils, and afterwards withdrawn on the understanding that the Committee would make certain concessions, it has been decided to introduce two overlapping stages in the Rawmarsh district, and that the workmen's ticket system, previously in operation, should be re-introduced. These alterations will come into force when the present fares are increased.

TELEGRAPH AND TELEPHONE NOTES.

Barbadoes.—Cable Controversy.—Officials of the Western Union Cable Co. declare that the cable from Barbadoes has been completed to within three miles and a half of the shore. It is stated that the cable can be connected with offices on shore, which are already prepared, within 24 hours after permission has been given by the State Department at Washington.

On September 23rd, representatives of the Cable Co. again urged Mr. Colby, the Secretary of State, to authorise the landing of the cable, but it is understood that the decision will be delayed until after the meeting of the International Communications Conference in October.—*Reuter.*

Canada.—Congress Resolutions.—At the Congress of Chambers of Commerce, at Toronto, a series of resolutions was adopted urging the development of telegraphic communication within the Empire, including the following:—

"Whereas the importance of direct cable communication between the United Kingdom and his Majesty's Dominions beyond the seas is an unquestioned and acknowledged fact; and whereas the passing of British telegrams through foreign, and possibly enemy, territory is a source of national danger be it resolved that this Chamber reiterates its opinion as to the urgent necessity of establishing without further delay cable communication between these Colonies and Great Britain, passing solely through British territory, and recommends that a sufficient subsidy be provided by the participating Colonies."—From the Trinidad Chamber of Commerce.

"Whereas the efforts being made further to develop trade between Canada and the British West Indies and British Guiana are seriously interfered with by the unsatisfactory cable service, under which messages are unduly delayed, mutilated, and lost; and whereas the Imperial Government, together with the Government of Canada and the West Indian Colonies, contributes a substantial subsidy to the West Indies and Panama Telegraph Co., and the contract with that company extends until 1924; therefore resolved that, with a view to facilitating the development of trade between Canada, the British West Indies, and British Guiana, the Canadian Government is hereby urged to confer with the Imperial Government and the Governments of the West Indian Colonies regarding (*a*) the procuring of immediate improvement in the cable service between Canada, the British West Indies, and British Guiana, and (*b*) the provision of a commercial wireless system between those countries."—From the Montreal Board of Trade.—*Reuter's Trade Service.*

Cleckheaton.—Chapel Telephones.—A local Congregational chapel has a pulpit-to-pew telephone system installed for the benefit of the worshippers who have deficient hearing. The transmitter is fixed on the reading desk of the pulpit, and the receivers are placed in about a dozen pews in the parts of the chapel usually occupied by these people. When out of use the receivers are packed in neat wooden boxes in the pews. The system works very satisfactorily.

Cuba.—New Cables.—The All America Cables, Inc., announced on August 23rd, that four permits had been received from the Government of Cuba to land cables on the Cuban coast,

which will result in greatly improved service between that country and the United States, as well as between the United States and Central and South American points. One of the cables is to be landed at Havana, the other terminal to be New York or some other American city. Another will land also at Havana, with the other terminal in Mexico or Central America; a third will be laid from Havana along the north coast of Cuba to the Bay of Guantanamo, and the fourth is to be from the Bay of Guantanamo to Santiago.—*T. and T. Age.*

France.—Wireless Storm Warnings.—An Admiralty Notice to Mariners, No. 1,236, of 1920, states that a system of wireless telegraphic storm signals for the coasts of France has been established by the French Government.

Honduras.—New Wireless Station.—The Ministry of Promotion has, according to the *T. and T. Age*, authorised Samuel Zemurray to erect a wireless telegraph station at Puerto Cortes.

Rumania.—New Wireless Station.—A wireless telegraphic station, erected by the Italian Marine, has been inaugurated at Bucharest; a smaller French station was erected there a short time ago. The new station can communicate with all stations in Europe.

Sweden.—American Telephone Cable.—The Swedish Government has ordered from the International Western Electric Co. a long-distance telephone cable to be placed between Stockholm and Goteborg, a distance of more than 10 miles. The cable is the latest type used by the American company, and employs relatively small gauge wire, but provides first-class service, due to its equipment with Pupin loading coils and telephone repeaters. By this means a great number of circuits is provided in a relatively small cable at a cost considerably less than an equivalent number of open-wire circuits. This cable is the first of a large network contemplated by the Swedish Government.—*T. and T. Age.*

The Department of Telegraphs proposes to raise considerably the telegraph and telephone rates. According to the new rates suggested, an inland telegram of 10 words would cost 1 krona, and each succeeding word 10 ores, instead of 5 ores, as previously.—*Reuter's Trade Service.*

Wireless Telegraphy Watchers.—Under the Merchant Shipping (Wireless Telegraphy) Rules, 1920, ships of Class II (*i.e.*, ships not engaged in the coasting trade carrying 50, but less than 200 persons, and ships engaged in the coasting trade carrying 50 persons or more) are required to carry, in addition to a certificated operator, one watcher if the voyage exceeds 8 hours, but does not exceed 48 hours from port to port, and two watchers if the voyage exceeds 48 hours from port to port. The Postmaster-General has made arrangements for examining watchers at Glasgow, Newcastle, Liverpool, Cardiff and London. Applicants should address their communications to the Wireless Telegraphy Inspector at the Post Office, Glasgow; Post Office, South Shields; Room 10, Prudential Buildings, 36, Dale Street, Liverpool; Port Office, Bute Docks, Cardiff; Wireless Section, Secretary's Office, General Post Office, London. Forms of application may be obtained at any of the above addresses, and the examination fee (2s. 6d.) should be paid by means of postage stamps affixed thereto. The candidate will be required to show that he is capable of receiving and understanding the wireless telegraph distress signal and the safety signal, and that he has sufficient knowledge of the apparatus to know that it is in proper condition to receive signals. If the candidate satisfactorily passes the examination he will be granted a certificate of proficiency as a watcher. Applications for instruction should be made to one of the wireless schools.—*Board of Trade Journal.*

Wireless Telephony.—When near Auckland, N.Z., a ship's wireless operator is reported to have heard quite distinctly voices transmitted on a wave-length of 450 miles from Avelon, near San Francisco. The distance between the two points indicated is, roughly, 5,000 miles.

New Zealand.—Increased Charges.—A new scale of telephone charges has been announced by the Postmaster-General. Subscribers who are situated some distance from an exchange have had their payments increased to a considerable extent. There is an additional flat charge of £1 a year for each connection. Under the regulations just superseded a business telephone more than half-a-mile, or a private connection more than a mile from an exchange is loaded with a further 10s. a year for every quarter of a mile, or fraction thereof, that it lies beyond that maximum up to three miles. Beyond three miles this charge rises to 15s. a year in each quarter of a mile. Under the new scale of charges there quarter mile increases are raised by 5s. each, so that, for a distance telephone, the subscriber will have to pay 15s. a year for each quarter-mile for the distance by which the maximum is exceeded up to three miles, and £1 for each quarter of a mile beyond three miles. The present charge for business connections up to half-a-mile from an exchange is £7 a year, while that for residence connections is £5 a year up to one mile from the exchange, with the extra charges for greater distances, as already mentioned. The charges for toll communications have also been increased for all distances above 20 miles.—*Auckland Weekly News.*

Wireless Institute.—With the idea of encouraging work in wireless telegraphy in the Dominion, it is understood that legislation will be passed this session to permit the formation of a New Zealand Wireless Institute. This body will have branches in various centres, and it is desired that a licence shall be granted to each local branch to install wireless apparatus and train persons interested in its use.—*Auckland Weekly News.*

Italy.—Since December, 1919, the greatest use possible of existing wireless stations to further communication with foreign countries and with the Italian colonies has been made. The following countries are in wireless connection, some limited to State messages, others open to private users and the Press. The S. Paolo station at Rome is in communication with England, France, the United States, Turkey (Constantinople), Georgia (Tiflis and ports of the Black Sea only), Germany, Anatolia (Adalia and Scalo Nuova), Russia (Moscow). The Centocelle station at Rome, with Dalmatia (Radio-Zara and Radio-Sebenico routes). The Coltano station, with Spain. The Pola station, with Bulgaria (Sofia), Roumania (Bucharest), Hungary (Budapesth), Austria (Vienna), Bohemia (Prague), Poland (Warsaw). The Taranto station, with Libya (Bengasi) and Salonica. The Brindisi station, with Albania. Near the Coltano station another station is in course of building, intended principally for Italian-American correspondence. The new station will have antennæ of a height of 250 metres, and will give forth continuous waves of a length of 16,000 metres, using 200 kw. The messages will be transmitted in duplicate. A scheme is afoot to build a powerful station on the continuous-wave system in Southern Italy for correspondence with the Balkan States and Eastern Europe. The building and working of this station may be made the subject of a concession to a private individual or firm.

CONTRACTS OPEN AND CLOSED.

(The date given in parenthesis at the end of the paragraph indicates the issue of the Electrical Review, *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Commonwealth Government. November 24th. Protected cable terminals and cable distribution boxes.

Queensland.—November 24th. P.M.G.'s Department. Iron poles (schedule 506), protected cable terminals, cable distributing boxes (schedule 507).

November 30th. P.M.G.'s Department. Protectors (schedule 505). (September 24th.)

October 6th. P.M.G.'s Department. Instruments and parts (schedule 499). (September 10th.)

Brisbane.—December 9th. Department of Public Works. Seventy three-phase oil-cooled core type static transformers.

January 20th, and February 25th, 1921. The City Electric Light Co. 10,000-kw. turbo-alternator set; transformers and switchgear.

Melbourne.—February 24th, 1921. The Victorian Electricity Commissioners. Turbo-alternators of 25,000, 12,500 and 600 kw., and other plant connection with the Morwell power scheme.

New South Wales.—November 25th. P.M.G.'s Department. Telegraph and telephone instrument and switchboard parts (schedule 753).

South Australia. — October 20th. P.M.G.'s Department. Telegraph instruments (schedule 546), and telephone instruments (schedule 549). (September 10th.)

November 3rd. P.M.G.'s Department. Telephone instruments (schedule 548). (September 10th.)

November 11th. P.M.G.'s Department. Telephone instruments (schedule 547). (September 24th.)

Birkenhead.—October 8th. Mersey Railway Company. Stores, including electrical sundries, collector shoes and brackets, metallic and carbon filament lamps and fittings. Mr. J. Shaw, General Manager and Secretary, Central Station, Birkenhead.

Birmingham. — October 11th. Salvage Department. Four electric vehicles for the removal of house refuse. (See this issue.)

Bradford. — October 28th. Electricity Department. Two natural-draught chimney-type cooling towers, pipework troughing, valves, &c. (Contract R 160). (September 24th.)

Dewsbury.—October 4th. Electric Wiring of Marlborough House (Kindergarten School), at Wheelwright Grammar School for Girls. Mr. G. E. Featherston, Secretary to the Governors, Technical School.

France.—Paris.—October 15th. Multiple commutator switchboards for the central telephonic offices at Portiers and St. Etiénne. Particulars, Direction de l'Exploitation téléphonique, 4e Bureau, 103, Rue de Grenelle, Paris.

Indo-China.—January 3rd, 1921. Construction of a generating station at Gia-Lam; construction of a pumping station at Dong-Du on the Red River; construction of an electric line between above stations; the working of the generating station and the pumping station. Particulars, Agence Générale des Colonies, Pièce 21, 2e étage, 27, Rue Oudinot, Paris.

India. — Agra. — October 22nd. Municipal Board. Complete generating plant, comprising: four Diesel engines and H.T. alternators; H.T. and L.T. switchgear, transformers and sub-station equipment; 15 miles underground H.T. cables, 28 miles overhead L.T. three-phase mains and street lighting equipment, complete with all accessories. (August 20th.)

Lincoln. — October 8th. Electricity Department. Spray cooling plant, 500,000 gallons per hour, with pipe and pipework. (September 10th.)

London.—London County Council.—October 25th. 125 tramcar bodies, 125 complete sets of maximum traction bogie trucks, and 125 electrical equipments, together with the assembling of same. (See this issue.)

Manchester. — October 20th. Electricity Committee. Specification No. B.9. Five 8,500 K.V.A. 3-phase transformers and fans, &c.; and three 6,000 K.V.A. 3-phase transformers and fans, &c. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

October 27th. Electricity Committee. Complete heating installation for the workshop and stores at the Barton power station. Mr. S. L. Pearce, Chief Engineer and Manager, Dickinson Street.

October 27th. Electricity Committee. Three mechanical water screens, and three grid screens. (Specification B. 10.) (See this issue.)

Rochdale.—Board of Guardians. Installation of new telephones at the Institution and Hospital, Birch Hill. (Sept. 24th).

Sheffield.—October 12th. Electric Supply Department. Two 10,000-KW. steam turbines, condensing plants, pipework, &c., alternators and exciters. (September 10th.)

Southampton.—October 8th. Electricity Department. One 5,000 K.W. 3-phase, 50 periods, 6,600 volts, turbo-alternator with condensing plant and accessories. (September 24th.)

Spain.—Tenders have recently been invited for the concession for the construction and working of an electric tramway between Matara and Argentona (Province of Barcelona.)

Uruguay.—December 18th. The Post Office authorities are, for the second time, inviting tenders for the construction of an underground telephone system here.

West Bromwich.—Corporation Electricity Department. Natural-draught cooling tower. (See this issue.)

CLOSED.

Australia. — Melbourne. — Electricity Supply Committee. Accepted :—

H.T. transformer switchgear, £1,543.—Ferguson Pailin, Ltd.
Ten 250 K.V.A. transformers, £5,495.—Gardner, Waern & Co.
30½ tons bare H.D. copper cables, £3,533.—B. I. & Helsby Cables, Ltd.
900 porcelain insulators, £225.—Australian Porcelain Co.

New South Wales.—Public Works Department. Accepted :—

Insulators for state transmission lines, £16,581.—Australian General Electric Co.

Steam driven electric generating plant, £11,770.—Australian General Electric Co.—*Tenders.*

Government Contracts.—The undermentioned Government contracts were placed during August, 1920.

Admiralty (Contract and Purchase Department).

Automatic telephone apparatus.—Relay Automatic Telephone Co., Ltd.
Batteries and cells.—Fuller's United Electric Works, Ltd.
Conduit tubing and accessories.—Barton & Sons; I. Birch & Sons, Ltd.; Brotherton, Ediswan Tubes & Conduits, Ltd.
Rewinding motors.—Electromotors, Ltd.
Erection of motor generator set.—G. E. Taylor & Co., Ltd.
Positive plates.—Tudor Accumulator Co., Ltd.
Electrically-driven saw bench.—A. Ransom & Co., Ltd.
Selector board and panels.—General Electric Co., Ltd

War Office.

Electric cells.—Siemens Bros. & Co., Ltd.
Rotor fans.—James Keith & Blackman Co., Ltd.

War Office (Army Contracts Department).

Block for electrical cells.—Siemens Bros. & Co., Ltd.
Electric cells.—Edison Swan Electric Co., Ltd.; Fuller's United Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Wireless telegraphy valves.—General Electric Co., Ltd.

General Post Office.

Protective apparatus.—Phœnix Telephone & Electric Co., Ltd.
Telegraph apparatus.—Automatic Telephone Manufacturing Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Cable bearers.—A. T. Cantwell.
Jointers' tool boxes.—W. Duncan, Tucker & Sons, Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; H. W. Smith & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Lamp caps.—C. A. Apperley (Karabon).
Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.
Ducts.—Jas. Oakes & Co.
Insulators.—J. Bourne & Sons, Ltd.; T. De la Rue & Co., Ltd.; Doulton & Co., Ltd.; Litholite Insulators, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Glow lamps.—General Electric Co., Ltd.
Plugs for telephones.—British L. M. Ericsson Manufacturing Co., Ltd.
Charging sets.—P. S. Doherty & Co.
Spindles for insulators.—T. W. Lench, Ltd.
Thermionic valves.—General Electric Co., Ltd.
Enamelled and silk cord copper wire.—London Electric Wire Co. & Smiths, Ltd.
Enamelled and flame-proof wire.—Macintosh Cable Co., Ltd.
Laying conduits, &c.—Palmer's Green-North Junction underground: O. C. Summers. Camberwell, Southwark, &c., disconnected: O. C. Summers. Kensington, Paddington and St. Marylebone, disconnected: O. C. Summers. Willesden, Wembley, &c., disconnected: O. C. Summers. City of London, disconnected: J. Mowlem & Co., Ltd. New Cross Road, S.E., underground: J. Mowlem & Co., Ltd. London-Dorking (Section III): J. Mowlem & Co., Ltd. New Bridge Street-Byron House, Fleet Street: J. Mowlem & Co., Ltd. St. Pancras, disconnected: D. R. Paterson, Ltd. London-Bristol-Newport (South Wales), Section II: Westminster Public Works Co., Ltd. Chiswick-Hammersmith, Western Junction: W. Iles. London-Bristol-Newport (South Wales), Section I: J. A. Ewart, Ltd.
Manufacture, supply, drawing-in, and jointing cable.—Leeds-York: British Insulated & Helsby Cables Ltd. Slough-Reading: Western Electric Co., Ltd.
Secondary cells.—Leeds Automatic Telephone Exchange: Chloride Electrical Storage Co., Ltd.
Telephone Exchange equipment.—Tottenham: Western Electric Co., Ltd. Sub-contractors for batteries: Tudor Accumulator Co., Ltd. Charging machine: Crompton & Co., Ltd. Bolton: Western Electric Co., Ltd. Sub-contractors. Batteries: Tudor Accumulator Co., Ltd. Charging machines: English Electric Co., Ltd. Southampton: Siemens Bros. & Co., Ltd. Sub-contractors. Batteries: Tudor Accumulator Co., Ltd. Ringing apparatus: Crompton & Co., Ltd. Grimsby: Siemens Bros. & Co., Ltd. Smethwick (Birmingham): British L. M. Ericsson Manufacturing Co., Ltd. Lancaster: British L. M. Ericsson Manufacturing Co., Ltd. Sub-contractors, batteries: Tudor Accumulator Co., Ltd. Starting switches: Bray Markham & Reiss. Voltmeter-ammeter: Elliott Bros. Charging machine: Crompton & Co., Ltd.

India Office: Stores Department.

Cells.—Chloride Electrical Storage Co., Ltd.
Electrical equipment.—British Thomson-Houston Co., Ltd.
Generating set.—Lancashire Dynamo & Motor Co., Ltd.
Harmonic ringers.—Automatic Telephone Manufacturing Co., Ltd.
Lift.—Waygood-Otis, Ltd.
Microphones.—Siemens Bros. & Co., Ltd.
Wheatstone transmitters.—Automatic Telephone Manufacturing Co., Ltd.
Wireless telegraph apparatus.—Marconi Wireless Telegraph Co., Ltd.
Electric wire.—T. Smith & Co., Ltd.
X-ray cubicle.—Watson & Sons, Ltd.

Crown Agents for the Colonies.

Cable, &c.—Siemens Bros. & Co., Ltd.
Lux cells.—Chloride Electrical Storage Co., Ltd.
Motor generator.—Crompton & Co., Ltd.
Switchboard cables, &c.—Western Electric Co., Ltd.
Telegraph ironwork.—Siemens Bros. & Co., Ltd.
Telegraph line material.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.
Telephone materials.—Siemens Bros. & Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.

H.M. Office of Works.

Engineering services.—Electric wiring Ipswich Training Centre: Cecil Cooper & Co., Ltd.
Telephone silence cabinets.—Siemens Bros. & Co., Ltd.

Metropolitan Police.

Rewiring electric light installation at New Scotland Yard.—Lund Bros. & Co.

Barnes.—Electricity Committee. Accepted : Extensions to the electricity works, £8,470, Mr. W. Lowe.

Hammersmith.—Electricity Committee. Recommended : Additional boiler house plant, gangways, ladders and handrails, for the new Stirling boiler.

Foster Construction Co., Ltd.	..	**£126**—Recommended.
H. W. Journet & Co.	..	£145
Stirling Boiler Co., Ltd.	..	£220

Coal supply.

25,000 tons of "Wernddu" through coal, 46s. 8d. per ton, f.o.r. Shepherd's Bush.—**Judd, Budd & Son.**—Recommended.

London.—St. Marylebone. Electricity Committee :—

Stand-by motor and clutches for the air-extraction pump to be supplied with the turbo-alternator, £125.—**Oerlikon Co.**—Accepted.
Additional switchgear, £559.—**Ferguson, Pailin, Ltd.**—Recommended.
Water separator, £204.—**Alton & Co.**—Recommended.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 1st. In the Great Hall, Cannon Street Hotel, E.C., at 8 p.m. Smoking Concert.

Electrical Power Engineers' Association (Manchester Section).—Saturday, October 2nd. At Milton Hall, Deansgate, Manchester. At 6.30 p.m. Address by Mr. Essex, Secretary of the N.E. Division.

Junior Institution of Engineers.—Friday, October 1st. At Caxton Hall, Victoria Street, S.W., at 8 p.m. Paper on "Notes on Factory Management," by Mr. H. N. Munro.

Edinburgh Electrical Society. — Saturday, October 2nd. At Fairley Restaurant, at 5.30 p.m. Social Evening.
Friday, October 8th. At the Philosophical Institution, Queen Street at 8 p.m. Paper on the "Electric Equipment of a modern Battleship," by Mr. R. Stark.

Salford Technical and Engineering Association.—Saturday, October 2nd. At the Royal Technical Institute, at 7 p.m. Paper on "Progress and Production," by Mr. J. Renshaw.

NOTES.

Summer Time.—The Home Office announces that the Government, in view of the possibility of the coal miners' strike taking place, has postponed the return from "summer time" to Greenwich mean time, which would normally have taken place at 2 a.m. on the night of September 26th-27th. An Order in Council has been made, substituting October 25th for September 27th, as the date on which "summer time" will end. Summer time in France will end on the night of October 23rd-24th.

Electrolytic Disinfecting Fluid.—In the course of his annual report for 1919, Dr. F. W. Alexander, medical officer of Health to the borough of Poplar, states that 33,285 gallons of electrolytic disinfectant were manufactured, making 66,570 gallons as diluted for distribution. The cost was, for materials, £139; electrical energy, £77; total, £216. The plant has now been running 14 years, and has manufactured 537,504 gallons of the fluid at a cost for electricity of £663, and materials £784 (about ½d. per gallon).

Industrial Accidents.—There were 1,384 fatal industrial accidents last year, said Mr. Gerald Bellhouse, Deputy Chief Inspector of Factories, at a Conference at Olympia, under the auspices of the British Industrial "Safety First" Association. Forty thousand accidents were due to machinery, and 84,000 were non-machinery cases. The accidents must generally be attributed to negligence, want of thought, or want of instruction. Twelve years' experience in America had shown that with a proper safety organisation 75 per cent. of all accidental deaths and injuries could be eliminated.

Scientific Literature.—A three-days' Conference on an international catalogue of scientific literature is being held at the Royal Society, from September 29th to October 1st. A large number of delegates are present from the Colonies and foreign countries.

Electric Vehicles.—The King's Lynn Town Council is considering the purchase of two electric vehicles; another vehicle is to be purchased by the Manchester Public Health Committee, the Mansfield General Purposes Committee is to acquire two electric tipping wagons at a cost of £1,820 each, while the Light Railways Committee of the Southend-on-Sea Town Council is to purchase an electric wagon. Messrs. Drake & Gorham, Ltd., have been awarded a contract by the Wallasey Town Council for the supply of two tipping wagons, at £2,882, for house-refuse collection purposes. The two vehicles are expected to economise 1s. 6d. per ton on loads carried, displace six horses, and save £500 per year. Messrs. Ransomes, Sims & Jefferies, Ltd., hope to deliver within about two months five standard 2½-ton "Orwell" refuse-disposal vehicles fitted with electrically-operated tipping gear, to the order of the Edmonton Borough Council. The Newport (Mon.) Corporation scavenging department has placed an order for a fleet of five "Orwell" tipping wagons, and another vehicle is being constructed for the local electricity department. From South Africa comes the news that the tender of the Griffin Engineering Co., Ltd., for the supply of an "Orwell" electric tower wagon has been accepted by the Johannesburg Municipal Council.—*Electric Vehicle.*

Service Notes.—Recruiting for the electrical departments of the Navy and Army is still going on, all the vacancies for tip-top men not having yet been filled in the R.A.F., R.E., and R.A.S.C. The wireless department is also wanting more men.

Raid on Electrical Apparatus.—On Sunday night, September 12th, Templemary Buttevant, the residence of Mr. R. P. Fuge, J.P., was raided by armed and masked men, in the absence of the family, and the housekeeper was held up. There were no arms in the house, except an old and useless gun; the raiders, however, carried off a large part of the valuable electrical testing instruments belonging to Mr. Fuge, amongst them a high-resistance Kelvin reflecting galvanometer, a standard microfarad condenser, a bridge (Post Office pattern), and various keys, telephones, &c. The telephone between the top and bottom of the house was torn from the walls.

Fatalities.—A curious accident, which involved the death of Edward Arthur Thornley, aged 27, electrician, of 122, Thornton Road, Shelton, was the subject of an inquiry by Mr. Hugh W. Adams (Coroner), at Fenton Town Hall, on Tuesday last week. According to the *Staffordshire Sentinel*, the deceased was employed at the Great Fenton Colliery, and about 7.40 a.m. on the 10th inst. he was in the act of turning off a switch, when, for some unknown reason, it exploded. Pieces of the switch struck him on the head, causing a fracture of the base of the skull. An engineman was also struck by the fragments.

Charles Osborne said he was in the compressor-house on the morning in question, and the deceased was turning off the isolating switch when there was a sudden explosion. Witness fell on the floor purposely, and he noticed that the deceased was lying in front of the switch. When he (witness) went to him, he found that he had sustained serious injuries to the head. He was unconscious.

Thomas A. B. Horsley, Electrical Inspector of Mines at the Home Office, said he had visited the colliery, and had examined the ruins of the switch. He had opened the cable end at the point where it joined the switch, and had tested the insulation of the cable, and had found no defect. He noticed some oil on the bottom of the switch-case. He removed the oil-box of the switch proper, and found no signs of defect in the switch. He had never known a similar accident. In his opinion, it was a case of pure misadventure.

A verdict of "Death from fracture of the base of the skull, caused by an explosion," was returned.

Following an operation for cancer, Ellen McLaughlan died in the Royal Infirmary at Liverpool. At the inquest, on September 21st, it was stated that during the operation the electrically-heated table became too hot, with the result that the patient was severely burned, and, despite prompt treatment, she died. The jury found that death was due to the condition of the kidneys following cancer, adding that it was accelerated by burns, which might have been avoided.

"Accidental death" was recorded at the inquest on the death of Charles Clayton Jowett (61), labourer, employed by the Bradford Corporation, who had been run over and killed by an electric coal wagon while working at the Corporation's electricity works. A rider was added that in future a man should be employed to keep a look-out, and thereby prevent accidents.

R.N.D. Signal Company's Dinner.—The second annual dinner and re-union of the R.N.D. Signal Company will take place at the Holborn Restaurant on Friday, November 5th. Morning dress. Tickets 10s. 6d. each may be obtained of Mr. A. G. Hilling, 1, Glaserton Road, N. 16.

Engineering Golfing Society.—The Autumn Meeting of the Society is to be held at Wimbledon on October 12th by the courtesy of the Royal Wimbledon Golf Club. An 18-hole medal round will be played in the morning for the "Hele-Shaw" scratch challenge cup and memento. Foursomes will be played in the afternoon, 18-hole match play against bogey, for the "Hadfield" challenge cups. Prizes will also be given in both morning and afternoon rounds. Entries close by first post on October 6th.

Freemasonry.—On Saturday last the Electric Lodge (No. 2,087) met at the Mitre Hotel, Hampton Court, Mr. John E. Hood, the W.M., being in the chair; the Lodge was honoured by the presence of Mr. A. Burnett-Brown, Deputy Prov. G.M. of Middlesex. An interesting feature of the proceedings was a presentation to Mr. Edwin J. Reid (of Reid Bros., telegraph engineers), of the Masonic clothing and regalia of Assistant Grand Superintendent of Works, in view of his recent appointment to that post, by Mr. Hood on behalf of the Electric Lodge, the North Kent Lodge (No. 2,499), the Telephone Lodge (No. 3,301), and the Kelvin Lodge (No. 3,736). The ceremony was attended by representatives of those Lodges, including Messrs. P. P. Kipping and F. A. B. Lord (Grand Officers), W. Aitken, and T. W. Greaves. Mr. E. E. Sharp (of the Tok switch) was elected Master for the ensuing year.

Conciliators in Harmony.—It is announced in the Press that a further meeting of representatives of the National Alliance of Employers and Employed and the Industrial League and Reconstruction Council was to be held on Wednesday to consider the proposed fusion of their organisations.

Educational.—MANCHESTER UNIVERSITY.—The extensions to the University so urgently needed, and the provision of additional staff, cannot be thought of at present, owing to the deplorable lack of funds. The total number of students during the past session was 2,775, an enormous increase on the previous session's total—1,619. One consequence of the shortage of staff has been an inevitable curtailment of research work. In spite of increased cost, the number of books published by the University Press has been greater than in any previous year. The scheme for classes for elementary school children has been limited by a lack of the necessary accommodation, but the large number of 2,500 have attended the Museum classes each week.

The Civils' Dinner.—Owing to the uncertainties of the industrial situation, says *The Times*, the Institution of Civil Engineers has abandoned the dinner which had been fixed for October 6th.

Appointments Vacant.—Instructors and demonstrators in civil and mechanical engineering (£315), and electrical engineering and applied physics (£315), for the Northampton Polytechnic Institute; charge engineers for the Yorkshire Electric Power Co.; deputy power-house superintendent (1,000 Rs. per month) for the Bombay Electricity Supply and Tramways Co., Ltd.; visiting teacher in electrical engineering for the London County Council School of Engineering and Navigation, Poplar; assistant engineer for the electrical installation (contracting) and electrical vehicle (garaging) department at Ipswich electricity department (£250); general manager (£500) for the Electric Light and Power Co. at Belize, British Honduras; charge engineer (£280) for the Borough of Bedford electricity department; plumber-jointer for the Derby Corporation electricity department; lecturers in physics, mathematics, and electrical engineering for the Birmingham Municipal Technical School; instructor in engineering, drawing, and mechanical engineering for the East Ham Education Committe. See our advertisement pages to-day.

Portable Electric Drills.—Our attention has been drawn to a recent performance of the Mark I "Westool" drill made by the Westminster Tool and Electric Co. This series of high-power, heavy-duty drills, which was illustrated on p. 415 of our September 24th issue, now covers the whole range of standard drill bits, and can be wound for any normal current. At one of the large iron-works in the north of England, there was a breakdown at a blast furnace, and a No. 3, Mark I "Westool" drill was used to drill a hole 2 in. diameter by 8 in. deep through wrought-iron with an 8-ft. spindle on the drill, as the machine could not be taken any closer to its work, because the furnace had to be kept working. This is considerably more than the guaranteed performance of the drill, as its normal rating is for 1½-in. holes, but it did the job without injury.

INSTITUTION NOTES.

Physical Society of London.—The forthcoming general discussion on "The Physics and Chemistry of Colloids and their Bearing on Industrial Questions" which is being arranged jointly by the Faraday Society and the Physical Society of London has been fixed to take place on Monday, October 25th, at the Institution of Mechanical Engineers, Storey's Gate, London, S.W. 1. The discussion will be presided over by Prof. Sir W. H. Bragg, K.B.E., F.R.S., and it will be introduced by Prof. Dr. The Svedberg of the University of Upsala, who will give a general survey of the subject before discussion is opened in its various branches.

Non-members of the above societies desirous of attending the discussion may obtain tickets of admission from Mr. F. S. Spiers, 10, Essex Street, London, W.C. 2.

Faraday Society.—The Faraday Society, the Institution of Mechanical Engineers, the Institute of Metals, and probably also the Iron and Steel Institute, contemplate holding early in 1921 a joint general discussion on "The Failure of Metals under Internal or Prolonged Stress."

While various aspects of the subject have already been discussed, some new matter will be placed at the disposal of the co-operating societies later in the year, and it is considered that this will afford an opportunity for a more comprehensive consideration of the subject than has yet been given to it.

The problem to be discussed is the failure of metal articles as a result either of external stresses to which they have been exposed for any length of time, or of internal stresses arising

from conditions of manufacture, such as cold work, unequal expansion or contraction during casting, and subsequent operations, including rapid heating and cooling. It is intended that the subject of the discussion should include the phenomena known as "season cracking," "corrosion cracking," "fire cracking," and analogous forms of failure, and that iron and steel as well as non-ferrous metals should be dealt with.

The scope of the discussion would permit of contributions relating to the properties and behaviour of materials other than metals which might throw light on the phenomena covered by the title.

Anyone desirous of contributing to this discussion is asked to communicate with the secretary of the Joint Committee, Mr. F. S. Spiers, 10, Essex Street, London, W.C. 3.

Liverpool Wireless Association.—The first meeting of the Association was held on September 22nd at the Royal Institution, Colquith Street.

A demonstration with a 3-valve receiving set, and a frame aerial—arranged by Messrs. Grindon and Williams—was very successful, excellent signals being obtained.

Mr. S. Lowery gave and explained data with regard to the winding and calculation of inductances.

Finsbury Old Students' Association.—The ninth annual dinner of the Finsbury Technical College Old Students' Association will be held at the Trocadero Restaurant, Piccadilly Circus, on Saturday, November 13th, when the chair will be taken by the President, Mr. John E. Raworth, F.C.I.P.A., A.I.E.E.

Old students may obtain tickets (15s. each, exclusive of wine) and particulars from the hon. secretary, Mr. H. P. Guy, 209, Northumberland Park, Tottenham, N. 17.

Edinburgh Electrical Society.—The opening meeting of the second session of the Edinburgh Electrical Society was held in the Philosophical Institute, Edinburgh, on September 24th, when Mr. D. Macintosh presided.

Prof. Baily, M.A., F.R.S.E., delivered a lecture on "Modern Traction by Road and Rail," which was illustrated by lantern slides. The development of traction systems during the last 50 years was interestingly summarised, and rival methods compared. Electric road and rail transport was specially considered, and details of the latest forms of electric locomotives were explained.

The following items are included in the programme of the session:—

October 2nd.—Social evening in conjunction with the local branch of the Association of Mining Electrical Engineers at Fairley's Restaurant.
October 8th.—"The Electrical Equipment of a Modern Battleship," by Mr. R. Stark.
October 21st.—Visit to *Scotsman* offices.
November 5th.—"Some Incidental Uses of Electricity." by Mr. B. A. Pilkington.
November 19th.—"Medical Electricity."
December 3rd.—"An Electrical Engineer's Walk Round a Factory," by Mr. J. Walker.
December 17th.—Electrical questions and answers.
1921.—
January 14th.—"Some Notes on Cables," by Mr. W. F. Mitchell.
January 28th.—"Electrical Wonders in Guernsey," by Mr. E. C. Catford.
February 11th.—Visit to North British Rubber Works.
February 25th.—"Telephone Troubles," by Mr. J. McEwan Brown.
March 11th.—Apprentices night. Short papers on everyday work, for Society's prize.
March 25th.—"Automatic Telephones," by Mr. W. Leithead.
April 8th.—Electrical questions and answers.
April 22nd.—Open night.
May 6th.—Annual meeting.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

At a smoking concert, held on September 24th, Mr. J. B. Parker, late assistant rolling stock superintendent, and Mr. A. W. G. Woodward, late electrical foreman of the Sheffield Corporation tramways department, who have recently been appointed general manager and electrician respectively to the Tees-side Railless Traction Board, received presentations from the workmen at Sheffield. The presentation was made by Mr. J. Smith, rolling stock superintendent. Mr. Parker has been presented with a gold watch by his colleagues on the staff.

Mr. H. Stowe, who has for 21 years been on the staff of the instrument department at the Arc Works of Crompton & Co., Ltd., of Chelmsford, is leaving for Australia, and his colleagues have presented him with a gold watch, and a gold albert and shield.

Mr. W. H. Blythe, for six years senior assistant of the research department of the British Westinghouse Co., Trafford Park, has been appointed travelling lecturer in electrical engineering to the Glamorgan County Council (Pontypridd district).

Southend-on-Sea Town Council has appointed Mr. S. Sharpe, who has been engaged to supervise the erection and working of the Diesel oil engines, as sub-station superintendent, at a salary of £352 per annum, rising to £378 when the whole of the six oil engines are in operation.

An Exchange Telegraph dispatch from Rome states that Signor D'Annunzio has conferred on Signor Marconi the title and insignia of a legionary. Signor Marconi has promised to erect at Fiume a very powerful wireless station at his own expense.

Mr. A. W. Stables, who recently arrived in London from New Zealand to succeed Mr. John R. Burt, as London manager to A. and T. Burt, Ltd. (New Zealand), Eldon Street House, E.C. 2, was, prior to joining Messrs. Burt, general manager of the New Zealand Hardware Co., Ltd. Mr. John R. Burt leaves London for New Zealand per *Remuera*.

Mr. C. Wilkinson, after 15 years' service as chief electrician with Messrs. T. Summerson & Sons, Darlington, has been presented by his colleagues with a gold watch. He is starting business as an electrician on his own account in the town.

Obituary.—Mr. R. Stewart Bain.—We deeply regret to record the death of Mr. R. Stewart Bain, which occurred suddenly from cerebral apoplexy. He had a seizure while engaged in his office on Monday, and was taken to Charing Cross Hospital, but never recovered. Mr. Bain, who was 61 years of age, was managing director of the London Electric Supply Corporation, Ltd. He was a chartered accountant, and had been associated with the "Deptford undertaking" on its financial and commercial side for some 30 years, having joined the company in 1888. Some years later, when the concern was passing through the serious financial trials which were the price of its pioneering enterprise in electricity supply, Lord Wantage made him Official Receiver. Subsequently he became managing director. For some years at the annual meetings of the company he followed the chairman with a speech in which he gave useful statistical and financial matter regarding operating results. The deceased gentleman was also on the boards of several non-electrical companies. Mr. Bain was most highly esteemed by all with whom he was associated, both in the London Electric Supply Corporation and in his relations with the boards of other London electricity supply companies. The industry has lost a gentleman who will be greatly missed.

Mr. F. Burns.—The death is recorded of Mr. Fred. Burns, electrician, Market Street, Barnsley, after a lengthy and painful illness

NEW COMPANIES REGISTERED.

Mullard Radio Valve Co., Ltd. (170,293).—Private company. Registered September 17th. Capital, £30,000 in £1 shares (10,000 8 per cent. cumulative participating preference). To acquire and turn to account the benefit of inventions connected with radio telegraphy and telephony and other methods of intercommunication, and apparatus, instruments, valves, and appliances connected therewith, &c., and to adopt an agreement with B. H. Binder (the liquidator of the "Z" Electric Lamp Co., Ltd.), and S. R. Mullard. The subscribers (each with 100 ordinary shares) are: Sir Ralph P. Ashton, Orient House, New Broad Street, E.C., East India merchant; H. J. Owens, Orient House, New Broad Street, E.C., clerk. So long as the Radio Communication Co., Ltd., Kilburn, Brown & Co., C. F. Elwell, S. R. Mullard, and E. H. M. Denny hold £2,500 shares each, they may be represented on the board by one director. The first directors are Sir Ralph P. Ashton (representative of Kilburn Brown & Co.); B. Binyon (representative of the Radio Communication Co., Ltd.); C. F. Elwell, and S. R. Mullard. Sir Ralph P. Ashton is the chairman. Solicitor: G. G. Warr, Palmerston House, 34, Old Broad Street, E.C. 2. Registered office: Orient House, New Broad Street, E.C.

Electric Gramophones, Ltd. (170,391).—Private company. Registered September 23rd. Capital, £1,500 in 1,450 preferred participating ordinary shares of £1 each and 1,000 deferred shares of 1s. each. To carry on the business of manufacturers of gramophones and talking machines and accessories, manufacturers of and dealers in motors, wires, apparatus, and electrical appliances, &c. The subscribers (each with one preferred participating ordinary share) are: K. O. Davis, "The Poplars," Chase Side, Enfield, engineer; C. J. Barnett, White Lodge, Church Street, Edmonton, engineer. The first directors are: K. O. Davis and C. J. Barnett. Registered office: 7, The Quadrant, Winchmore Hill, N. 21.

Presteign Electric Co., Ltd. (170,355).—Registered September 21st. Capital, £5,000 in £1 shares. To carry on the business of an electric light and supply company, &c. The first directors are: Rev. H. L. Kewley, Presteign, Radnorshire; H. J. Sparey, Presteign, Radnorshire; A. M. Wilson, The Moor, Presteign. Minimum cash subscription 7 shares. Qualification 25 shares. Secretary: F. L. Green. Solicitor: F. L. Green, Presteign.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dickinson Electrical Manufacturing Co., Ltd.—Particulars of £2,000 debentures and bonuses for £80 authorised July 29th, 1920, whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital.

Lancashire Power Construction Co., Ltd.—Return dated July 8th, 1920. Capital, £689,838 in £1 shares (400,000 first preference, 137,500 preference, and 152,838 ordinary), all shares taken up. £680,477 2s. paid, £2,400 considered as paid. £6,960 18s. in arrears. Mortgages and charges, £288,000.

Magic Appliances, Ld.—Particulars of £2,000 debentures authorised July 27th, 1920, whole amount issued, charged on the company's property, present and future, including uncalled capital.

Tees-side Electric & Plumbers' Stores, Ltd.—Mortgage dated August 6th, 1920, to secure all moneys due or to become due from company to London Joint City & Midland Bank, Ltd., 55, Lower Reed Street, West Hartlepool.

South-Western Engineering Co., Ltd.—Debentures dated September 9th, 1920, to secure £2,000 charged on company's property, present and future, including uncalled capital. Holders: J. Watt, Sangley Estate Office, Bromley Road, Catford, S.E., and E. C. Stansbury, 6, New Square, Lincoln's Inn, W.C.

Salmon & Pagis, Ltd.—Debentures dated September 1st, 1920, to secure £4,200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. R. D. Pritchett, 78, Knightsbridge, S.W.

Saunders Electrical Co., Ltd.—Mortgage and equitable charge on leasehold offices and workshops in Godiva Street, Coventry, both dated September 9th, 1920, to secure £1,000 and £500 respectively. Holders: G. Masters and H. Masters, of Ayton-on-Dunsmore, Warwick, and J. T. Moore, Priory Road, Coventry, and G. E. Stanley, 23a, Coundon Road, Coventry.

Yorkshire & District Electric Lamp Repairing Co., Ltd.—Mortgage dated July 16th, 1920, to secure £1,500 charged on "Heeley Mill," Heeley, Sheffield. Holders: Mrs. E. L. Steel, "The Firs," Aston Abbots, Bucks., and J. E. Wing, 70, Queen Street, Sheffield.

Chloride Electrical Storage Co., Ltd.—Return dated June 2nd, 1920. Capital, £300,000 in £1 shares (62,000 preferred, 219,750 ordinary, and 18,250 unissued), 62,000 preferred and 219,750 ordinary shares taken up. £75,738 paid. £206,012 considered as paid. Mortgages and charges, nil.

Chile Telephone Co., Ltd.—Return dated August 3rd, 1920. Capital, £500,000 in £5 shares. 99,000 shares taken up. £275,000 paid. £220,000 considered as paid. Mortgages and charges, nil.

Rangoon Electric Tramway & Supply, Ltd.—Return dated April 7th, 1920 (filed July 24th, 1920). Capital, 2500,000 in 50,000 preferred shares of £5 each and 250,000 ordinary shares of £1 each. 50,000 preferred and 177,001 ordinary shares taken up. £361,999 paid, leaving £2 in arrears. £65,000 considered as paid. Mortgages and charges, £258,002.

Liverpool Electric Cable Co., Ltd.—Return dated August 3rd, 1920. Capital, £30,000 in £1 shares. All shares taken up. £7,833 paid. £22,167 considered as paid. Mortgages and charges, nil.

Marconi International Marine Communication Co., Ltd.—Return dated July 2nd, 1920. Capital, £1,500,000 in £1 shares. £1,192,726 shares taken up. £1,087,726 paid. £105,000 considered as paid. Mortgages and charges, £78,320.

STOCKS AND SHARES.

TUESDAY EVENING.

RELEASED from immediate fear of a miners' strike, the Stock Exchange markets at the beginning of the week adopted a cheerful tone that spread throughout most of its sections. Had it not been for the trotting-out afresh of what are called "money fears," the disposition would have been more cheery still. But some unkind persons began to throw out hints concerning an 8 per cent. Bank Rate, and these did not fail of their effect upon the purely investment securities. If the strike does not take place, public attention will be turned to the way in which the finances of the country are wading steadily deeper into the mire, and this will lead to talk of a new national loan on the grand scale.

City talk runs upon the possibility of the Excess Profits Duty being either substantially reduced, or else abandoned altogether, when the Budget is "broken" next spring. Unless conditions alter in some miraculous way, it is taken for granted that removal of E.P.D. would merely be the excuse for imposition of other taxes. The Corporation tax offers manifest temptation to a hardly-pressed Chancellor of the Exchequer. This is so generally recognised that already there are members of semi-private companies discussing the advisability of dissolution of the companies and reverting to an "unlimited" status in order to escape the incidence of a tax which, even in its present form, presses harshly upon many of those called upon to pay it.

Last week's rise of eleven points in Underground Electric income bonds brought in a certain amount of selling, but the price kept hard, and shows a gain of 1 on the week. The £10 shares are, however, ½ lower at 2½. In spite of a good deal of advance advertisement of the forthcoming change in fares, there has been much grumbling on the part of passengers. Moreover, the increases in omnibus fares are unexpectedly large, and as penny tickets are almost done away with, Londoners are threatening to walk the shorter distances. Districts are ¼ higher and Metropolitans keep steady. London United Tramways 4 per cent. debenture stock remains at 32½. British Electric Traction 4½ per cent. second debenture stock was sold the other day at 54½. The ordinary is about 31½, and 6 per cent. participating preference stock stands at 64.

Metropolitan Electric ordinary recovered ½ to 2½. Bournemouth and Poole ordinary advanced to 5½, but the preference at 5½ are ¼ down. Newcastle-on-Tyne 7 per cent. preference at 19s. show a slight gain. Oxford ordinary and preference both stand at the same price, 2½. North Metropolitan 6 per cent. preference are dull at 11s. 3d. St. James and Pall Mall 7 per cent. preference stand at 4½, and the 3½ per cent. debenture is 68. River Plate ordinary remains firm at 105, the 6 per cent. preference being 76. Smithfield ordinary are 15s.

The manufacturing group retains the improvements secured upon the settlement of the electricians' troubles. Callender's are better at 26s. 3d., Siemens rose to 25s., Babcock & Wilcox put on ¼ to 50s. English Electrics are 18s., and the 6 per cent. preference 15s. 6d. General Electric 7½ per cent. "B" preference keep very close to 20s. A sharp spurt occurred in rubber shares, on the produce rallying to 1s. 8½d., but the market for the raw material threatened to give way again, and part of the rise in the shares was lost. The little spurt produced sufficient business to demonstrate that public interest in rubber shares is less dead than dormant.

United River Plate Telephone shares have been flat, falling to nearly 6 before there was a recovery to 6¼, at which latter price the shares are ¼ down on the week. Chili Telephones are also lower at 5½. The cable market as a whole, however, keeps steady, and there is a good deal of investment business doing in the Eastern group. Globe ordinary at 14½ are ¼ down, and the American stocks continue somewhat heavy. Indo-Europeans changed hands as low as 25. American Telephone and Telegraph capital stock is better at 137½ ex dividend. The 4 per cent. bonds have risen to 109 and the 4 per cent. convertible bonds to 92½. The New York rate of exchange continues to have a favourable effect upon the prices of most of the dollar securities. Marconis are a stronger market at 2 13/16. We believe it to be the case that the partner of an influential house in London has recently been to New York to consult with the directors of the Radio Corporation in regard to the technical difficulties that have arisen in connection with starting a market in Radio shares on this side. In the Stock Exchange it is said that negotiations are being pressed forward as rapidly as possible with a view to enabling the establishment of a market in the Radio Corporation (neé American Marconi) shares in this country. There is a vague tip going about as to its being right to buy Canadian Marconi on the basis of half-a-guinea, but it deserves mention only as affording a hint to holders of the shares that it may be worth their while to keep them.

Brazilian Tractions have given way to 46, and in the Argentine Tramways stocks, Anglo-Argentine Tramway 5 per cent. debenture stock fell to 54½. In Mexicans, there is not much doing, though the tone is rather easier than it was last week. Apart from the rises in dollar stocks already mentioned, the list of foreign electrical issues shows no change of any consequence.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Sep. 28, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	8	12	6½	—	£9 13 0
Charing Cross Ordinary	4	7	8½	—	10 16 6
do. do. do 4½ Pref.	4½	4½	22	—	8 3 8
Chelsea	3	4	26	—	7 19 5
City of London	8	10	14	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	7	8	7½	—	10 17 0
do do. 6 per cent. Pref.	6	6	8¼	—	7 7 8
Kensington Ordinary	6	7	8½	—	9 0 6
London Electric	Nil	2½	1½	—	6 0 0
do. do. 6 per cent. Pref.	6	6	8	—	15 0 0
Metropolitan	5	6	22	+ ½	10 18 2
do. 4½ per cent. Pref.	4½	4½	21½	—	8 0 0
St. James' and Pall Mall	10	12	62	—	9 1 3
South London	5	6	9 3/xd	—	10 1 8
South Metropolitan Pref.	7	7	17/-	—	8 4 8
Westminster Ordinary	8	10	5	—	10 0 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	77½	—	£7 14 10
do. Def.	33/6	1½	17½	—	£8 12 10
Chile Telephone	8	8	5½	— ¼	£5 9 1
Cuba Sub. Ord.	7	7	7½	—	£9 6 8
Eastern Extension	8	10	14½	—	£8 14 4
Eastern Tel. Ord.	8	10	14½	—	£8 14 4
Globe Tel. and T. Ord.	8	10	14½	— ½	£8 18 0
do. do. Pref.	6	6	8 3/xd	—	£7 1 2
Great Northern Tel.	22	22	20	—	11 0 0
Indo-European	15	10	30	—	6 6 8
Marconi	25	25	2½	+ 1/16	2 17 0
Oriental Telephone Ord.	10	12	24	—	£4 16 0
United R. Plate Tel.	8	8	6½	— ½	£6 8 0
West India and Panama	1/3	Nil	¼	—	Nil
Western Telegraph	8	10	14½	—	£8 14 4
HOME RAILS.					
Central London Ord. Assented	4	4	41½	—	9 12 10
Metropolitan	1	1½	21½	—	5 16 8
do. District	Nil	Nil	18	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	3	4	67½	— 1	—
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams First Pref.	Nil	5½	8½	—	8 9 2
do. do. 2nd Pref.	Nil	Nil	8½	—	Nil
do. do. 5 Deb.	5	5	54½	— ½	9 2 6
Brazil Tractions	Nil	Nil	46	—1	Nil
Bombay Electric Pref.	6	6	12½	—	4 10 7
British Columbia Elec. Ry. Pfce.	5	5	54	+1½	9 5 2
do. do. Preferrred	2½	5	48½	—	£7 4 4
do. do. Deferred	Nil	3	47	+ ½	£7 9 0
do. do. Deb.	4½	4½	63 3/xd	—	£7 19 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	44	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	34	—1	Nil
Mexican Light Common	Nil	Nil	15	—1	Nil
do. Pref.	Nil	Nil	28½	+1	Nil
do. 1st Bonds	Nil	Nil	58	—	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	24	+ ½	£5 0 0
British Aluminium Ord.	10	10	1 3/16	—	10 0 0
British Insulated Ord.	12½	15	1 13/16	—	8 5 6
Callenders	25	15	1 7/16	+ 1/16	10 8 6
" 6½ Pref.	6½	6½	18/-	—	7 4 5
Castner-Kellner	20	17	5	—	5 18 4
Crompton Ord.	10	10	17/6	—	11 8 6
Edison-Swan, "A"	10	10	21/-	—	9 10 8
do. do. 5 per cent. Deb.	5	5	78½	—	6 5 9
Electric Construction	10	10	18/3	—	10 19 2
Gen. Elec. Prof.	6½	6½	18/6	—	7 0 5
do. Ord.	10	10	28/-	—	£7 2 10
Henley	25	15	1¾	—	9 4 8
do. 4½ Pref.	4½	4½	8½	—	7 4 8
India-Rubber	10	10	1½	—	£5 0 0
Met.-Vickers Pref.	—	8	2½	—	7 6 2
Siemens Ord.	10	10	25/-	+6d.	£5 0 0
Telegraph Con.	20	20	20	—	£5 0 0

* Dividends paid free of Income Tax.

Browett, Lindley & Co., Ltd.—Interim dividends of 4 per cent. (actual) on the ordinary shares, 3 per cent. (actual) on the preference shares, and 3 per cent. (actual) on account of arrears.—*Financial Times.*

Shanghai Electric Construction Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, less tax.

Auckland Electric Tramways Co., Ltd.—The revenue for the year ended June, 1920, was mainly composed of interest upon the Corporation debentures, less interest on loans and advances. It amounted to £63,083. After paying all expenses, debenture interest, preference dividend, &c., a dividend of 1s. 3d. per share, less income tax, on the ordinary shares is to be paid, and £9,610 is to be carried forward.

OPPORTUNITIES IN THE ARGENTINE REPUBLIC.

[A Rich Field for Engineering Enterprise.]

In view of the pioneer work undertaken by United Kingdom firms and individuals in engineering enterprises in the Argentine Republic, and the interest which they have in consequence in the general economic condition of that country, there is much to encourage British financiers and manufacturers in the report by H.M. Commercial Secretary at Buenos Aires (Mr. H. O. Chalkley), which has recently been issued by the Department of Overseas Trade.

Argentine is still essentially a pastoral and agricultural country, any growth in manufacturing industry having been retarded by lack of iron, coal, water power, and skilled labour. How far this state of affairs will be altered if it is found possible to turn the Iguazú waterfalls to industrial uses by the generation of electric power remains to be seen.

Interest in the possibility of installing a hydroelectric station at Iguazú has been revived, on the initiative of the Argentine Minister of Foreign Affairs, after a visit to the locality, and the Government has authorised a thorough hydraulic survey of the river with a view to determining its effective water power. The Brazilian Government have been approached with a view to obtaining their co-operation or authorisation for carrying out the surveys in the zone under their jurisdiction. At the same time the Minister of Public Works is charged with the task of preparing the outline of a scheme for the utilisation and transport of this power to Buenos Aires and other large centres of consumption. The falls are situated on the border line between Argentina and Brazil, some 800 miles from Buenos Aires. They have 275 cascades, one of which has a sheer drop of 213 feet. The opinion of United States engineers, obtained through the Argentine Embassy at Washington, is that the scheme is technically feasible. The financial and engineering factors involved in its realisation, however, are so formidable that there is no early prospect of the project being undertaken either by State or private enterprise.

The drive most extensively adopted for electric generating sets in the Argentine for some time to come is likely to be oil, more particularly in view of the promising results which have attended the working of the Comodoro Rivadavia field. The production does not yet suffice for more than a small part of the fuel requirements of the country, but development has been retarded by the difficulties of obtaining tank steamers, machinery, and plant during the war. Since Mr. Chalkley's report was written, the Buenos Aires and Pacific Railway Co. has made arrangements to take an active part in working the field. It may be added that petroleum also exists in the districts of Jujuy, Salta, Mendoza, and Neuquen.

There are no developments to report in connection with electric traction, the only line so operated being one of the three suburban sections at Buenos Aires, of the Central Argentine Railway, which section was electrified three years ago. It is intended to adopt similar means of traction on the other two sections in the near future. The electric generating machinery is run by steam plant in which, owing to the coal shortage during the war, not only has oil and wood been used, but even maize.

A scheme to erect a municipal electric light and power plant at La Plata, the capital of the province of Buenos Aires, has been laid before the municipal council of that city, but the difficulty of finance and the fact that there is already a private light and power enterprise in existence are likely to impede approval of the project. The total cost of the plant, which would be equipped with Diesel engines, is estimated at $5,800,000.

Among interesting concessions recently granted by the Municipality of Buenos Aires are those for the establishment of a service of motor omnibuses, which are at present quite unknown on the streets of Buenos Aires, and for the installation of an automatic telephone system.

The Board of Sanitary Works has dealt with tenders for a complete installation of new plant at the central pumping station of Palermo, for electrical plant for the central and sub-station of the southern zone of the city, for 22,000 tons of cast-iron pipes, and large quantities of stoneware pipes. Further tenders for cast-iron piping will be called for if there is any likelihood of more favourable prices and deliveries.

Apart from public utility schemes such as the foregoing, British engineering and allied firms will find it useful to watch the movement which has gained strength in the Argentine during the war, for starting various branches of manufacture. In this connection factory plant and equipment, as well as accessory material, will be needed.

The manufacture of electrical appliances benefited by war conditions, although not to such an extent as seriously to affect importation.

The following table shows the value of the imports into the Argentine of certain goods of interest to United Kingdom engineers. The countries of origin are given for two representative years, and the total values added for 1918 and the first six months of last year:—

Article and country of origin.	Nominal value in gold pesos. 1913.	1917.
Dynamos and Electric Motors.		
Germany	508,711	5,205
United Kingdom ...	467,363	62 965
Italy	70,016	18,600
United States... ...	47,168	78,057
France	19,982	2,296
Switzerland	3,550	32,223
Other countries ...	10,701	3,314
Total	1,127,491	203,060
„ 1918 ...	—	145,288
„ 1919, 6 mos.	—	91,637
Spare Parts for Machinery.		
United States... ...	796,673	296,716
Germany	698,671	—
United Kingdom ...	593,787	147,418
Belgium	299,199	—
France	178,548	25,652
Italy	56,950	14,019
Australia	29,251	—
Canada	25,265	2,074
Other countries ...	56,124	14,535
Total	2,734,468	500,414
„ 1918 ...	—	367,157
„ 1919, 6 mos.	—	219,288

Article and country of origin.	Nominal value in gold pesos. 1913.	1917.
Boilers.		
United Kingdom ...	942,790	21,671
Germany	82,917	—
Belgium	19,608	—
United States... ...	15,569	2,238
Other countries ...	26,672	1,000
Total	1,087,556	24,909
„ 1918 ...	—	68,727
„ 1919, 6 mos.	—	22,250
Sundry Machines.		
Germany	2,886,625	4,077
United Kingdom ...	1,355,353	226,820
United States... ...	844,572	610,674
France	398,583	25,819
Belgium	204,427	—
Italy	146,296	14,531
Sweden	140,866	19,811
Switzerland	70,715	18,304
Holland	56,141	2,608
Austria-Hungary ...	53,970	—
Spain	17,254	7,325
Paraguay	—	102,621
Canada	3,377	—
Other countries ...	32,259	7,307
Total	6,210,438	1,039,897
„ 1918 ...	—	732,956
„ 1919, 6 mos.	—	514,799

Article and country of origin.	Nominal value in gold pesos. 1913.	1917.
Tramway Materials.		
Germany	612,178	—
United Kingdom ...	254,527	11,248
Belgium	162,778	—
United States... ...	56,698	19,077
Other countries ...	5,369	120
Total	1,091,550	30,445
„ 1918 ...	—	52,358
„ 1919, 6 mos.	—	22,106
Wire for Electrical Use and Cables.		
Germany	2,308,394	36
United Kingdom ...	2,023,900	151,233
Italy	382,281	188,455
United States... ...	120,789	373,930
France...	73,873	6,971
Belgium	33,047	—
Holland	1,677	1,368
Spain	—	9,989
Switzerland	769	12,640
Other countries ...	901	1,808
Total	4,945,631	746,430
„ 1918 ...	—	655,102
„ 1919, 6 mos.	—	394,023

The year 1920 opened with most satisfactory prospects for Argentine prosperity. That such prosperity is of importance in the economic reconstruction of Europe will be realised from the fact that with a population of less than 9 million inhabitants the Republic imports goods, the bulk of which Europe could normally supply, to the value of £100,000,000 per annum, and exports products which Europe needs to a value which is approaching £200,000,000 annually.

The war had the effect of throwing Argentina on its own resources, consolidating the position it had secured, compelling the accumulation of wealth by production, enforcing economy in consumption, and curtailing opportunities for the extravagance, unproductive expenditure, and inflated credit trading which had become a habit. The result is, that the country, although expansion has been suspended for five years, is richer as a nation than at any previous time, with

a large part of its foreign indebtedness liquidated, the exports of produce showing every year an excess over imported merchandise and commerce financially sound.

The total value of the Argentine import trade may, as stated, be taken at £100,000,000 sterling, including cost, freight, and insurance at Argentine ports. Before the war the United Kingdom held steadily 31 per cent. of this trade, while the United States held 15 per cent. The position at the end of the first year from the conclusion of the war is that the United States has secured 33 per cent. of the Argentine import trade, while the United Kingdom retains some 20 per cent.

In the competition between the United States and the United Kingdom, the prospects of the United Kingdom would normally depend upon the demand for her goods, prices, and credit facilities. To-day they depend upon ability to supply and prices. All conditions of demand are heavily in favour of the United Kingdom, the extension of credits has become a secondary consideration, and the problem is simplified to a question of delivery, prices, and freights. If British manufacturers can deliver in approximately the same time as their United States competitors, at prices which are equivalent to or not greatly in excess of those of the United States, they should regain their leading position in the Argentine market.

British trade has the advantage of a strong and firmly established connection with Argentina in the form, first, of resident British firms and traders with life-long experience of the requirements of the market, and, secondly, of the old-established houses of other nationalities in Buenos Aires, whose appreciation of British exporters' methods and merchandise has been greatly increased by their experiences during the war. This advantage of established connections and mutual knowledge will have great weight if British industries can produce the merchandise required at competitive prices.

There is also on the side of the British the legitimate influence due to the heavy investment of British capital in Argentine enterprises of all descriptions. The place of the United Kingdom as the source of such capital has not been taken by any other country. The United States increased their trade by following the German system of merchanting rather than the British system of investing, and for that reason their prospects may be regarded as being less favourable.

Representatives of German manufacturers are offering merchandise on the Argentine market at prices below those at present ruling for similar articles. These agents admit that the goods on offer are from stock, and that firm orders for new articles cannot be taken by them at present. The principal lines offered by German agents are industrial machinery, hardware, heavy chemicals, and aniline dyes. Sellers are quoting in marks for shipment f.o.b. Amsterdam, without promise of fixed dates for delivery.

It is good news to learn from Mr. Chalkley's report that there is no longer much ground for the criticisms made before the war of lack of interest and conservative methods on the part of the British manufacturers. In view of the difficulties of transforming industries from a war to a peace basis, of the uncertainty with regard to labour, raw materials, &c., and of the more intensive demand on production of the home, colonial, and European markets, they have done as much as could be expected since the Armistice in the way of preparations to regain their former trade in the Argentine market. Importers report that British manufacturers are more willing to receive particulars of and to comply with special local requirements than they were before the war. Keen representatives of an acceptable standard continue to arrive at Buenos Aires, fresh agency arrangements are being formed and existing agencies revised, while new methods of propaganda, investigation, and selling organisations are being adopted. The British textiles, machine tools, agricultural machinery, electrical and aviation industries have shown special activity in this respect.

All these efforts should bear good results when settled conditions of labour in the United Kingdom will permit of their being followed by production and export on a large scale.

MODERN MARINE PROBLEMS.

By C. V. DRYSDALE, O.B.E., D.Sc., M.I.E.E.

(*Abstract of the Eleventh Kelvin Lecture delivered before the* Institution of Electrical Engineers.)

(*Concluded from page* 411.)

IV. General Scientific Research.

The last section deals with fundamental scientific research. The great importance of a thorough knowledge of submarine physics, and especially of the transmission of disturbances of every character through the sea is insisted on. The chief fundamental questions to be settled are the laws of propagation of acoustic, electromagnetic, and optical waves in the sea. In addition it is most necessary to have methods of measuring the absolute values of the energy, &c., transmitted and received, and for investigating the properties of various transmitters and receivers.

The velocity of propagation of sound in sea water may be taken as 15,120 metres per second at 16.7 deg. C., as compared with about 14,500 metres per second for fresh water. The variation of velocity with temperature, which is probably somewhat high, has not yet been determined, but experiments are in progress at Shandon.

During the past year considerable development has been carried out on the metrical determination of sound intensities. As a standard source of sound a transmitter was used that was excited by a high alternating voltage derived from a valve oscillating set which produced sound waves of known amplitude. The received intensity can be observed by a standard receiver connected to a three-valve resistance amplifier and a thermo-galvanometer. Potentiometer methods of measuring the amplification have been devised. Up to the present these methods have been employed chiefly for determining the characteristics of various forms of receivers and fig. 13 shows the variation of the potential difference developed by a magnetophone for different frequencies, for a constant amplitude of the standard source. The magnetophone was connected in line with a single 4,000-ohm earpiece, with a constant pressure of 800 volts at the source, corresponding to a maximum amplitude of 2.74×10^{-6} cm. The natural frequency of the magnetophone receiver in air was for curve A 1,300, and for B 600; hydrophone at 2 cm. from the surface. This curve strikingly shows the selective properties of the receiver owing to the natural frequency of its diaphragm, and illustrates how such a receiver may modify the nature of the sound received.

The lecturer has proposed to extend these methods for a complete investigation of the transmission and reflection of sound in the sea, but to employ the A.C. potentiometer for the measurements, as this determines both the magnitude and phase of the disturbance. As this potentiometer will make measurements at a frequency of 1,000 cycles per second to within 0.0001 volt, and within 0.1 or 0.2 degree of phase, it is particularly suitable for the purpose. At this frequency 1 degree of phase displacement corresponds to a time difference of 1/360,000th second, so that 0.2 degree corresponds to about one two-millionth second, and the time required for an acoustic wave to travel only one foot can be determined to about one part in 400 or closer. By using a standard transmitter of spherical form, and employing the potentiometer in conjunction with a receiver and resistance capacity amplifier, measure-

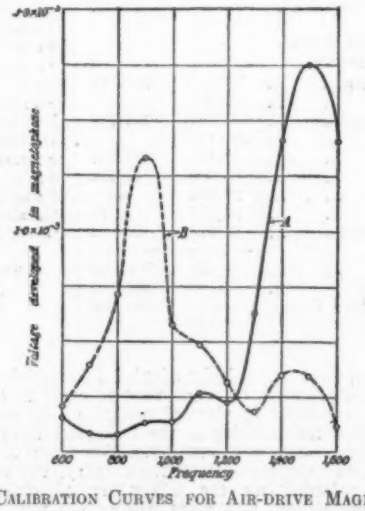

Fig. 13.—Calibration Curves for Air-drive Magnetophone.

ments can be accurately made over short distances, and can, therefore, be carried out for a preliminary investigation in a moderate-sized tank without serious trouble from bottom and side reflections, which can be practically eliminated if necessary by suitable acoustic lagging. In this way temperature changes can be conveniently studied.

The importance of research on electromagnetic propagation, on account of the high absorption of sea water, has been

emphasised. In January, 1918, the lecturer made approximate measurements to ascertain the effect of absorption on the E.M.F. induced in a search coil lying on the bottom, in the middle of a rectangular loop 300×200 yards wide, laid in the mouth of Harwich Harbour in about 20 ft. of water. These measurements were made by means of a galvanometer and rotating commutator on board a moored ship from which alternating current was supplied to the loop, and showed that at frequencies from 10 to 20 cycles per second the loss of E.M.F. by absorption was only 10 to 20 per cent. The position of the loop was located by a search coil and telephone with amplifier similar to the arrangement afterwards employed for the aural leader gear. Certain phenomena connected with leader gear led to further investigation of the magnetic field surrounding the cable at sonic frequencies, with the result of discovering that this field was nearly horizontal at moderate distances from the cable, instead of nearly vertical, as would be anticipated from the ordinary theory. When the visual leader gear was proposed, it was anticipated from the small amount of absorption found at sub-sonic frequencies that the distortion would also be small, but experiments soon showed that this was not the case, and a series of field disturbance tests were made by means of the inclined coils on H.M.S. *Auricula* at various frequencies from 10 to 50 cycles per second showing large distortion which increased as the frequency was raised. By connecting the coils in series it was possible to estimate the relative phases of the electromotive forces in the two coils, from which it appeared that the field was of an elliptically rotating character in this region. These experiments were conducted on an iron ship, but the coils were so large and high that it is not probable that very

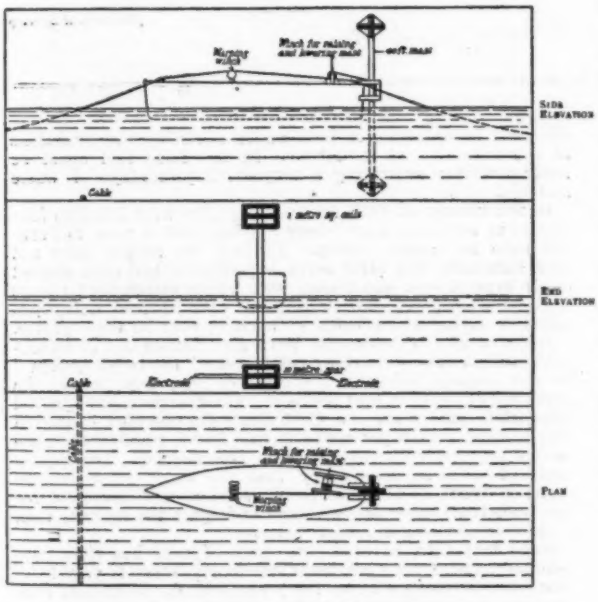

Fig. 14.—Arrangements for Field and Current Distribution Tests Round Submarine Cable.

serious distortion was caused by the hull. A mathematical investigation indicated that the effect was most probably due to the "skin effect" in the water, which caused the return current from the end of the cable through the sea to crowd in upon and over the cable, and also to refraction of the electromagnetic waves on escaping from the sea into the air. Preparations are now nearly completed for a rigorous experimental investigation of this phenomenon. A wooden barge is being equipped with a tall wooden mast, to the upper and lower ends of which a pair of horizontal and vertical search coils are fixed for determining the two components of the magnetic field (fig. 14). The mast can be raised and lowered so that the two upper coils can be fixed at any desired height above the surface, and the two lower ones at any depth beneath it. In addition, a long horizontal spar with electrodes at its ends is attached to the bottom of the mast, and leads brought along it which as well as the connections from the four search coils are brought into a multicore cable running to an observing hut on Shandon pier. This pier contains an A.C. potentiometer which will measure the amplitude and phase of the E.M.F. induced in the search coils and of the potential difference between the electrodes which is proportional to the current density in the sea.

The cable is laid for a distance of about 2 miles along the loch as straight as possible, and about 300 yards from the observation hut. At a point directly opposite the pier a junction box is inserted containing a 0.01-ohm resistance, the potential terminals of which are connected through a two-core cable to the potentiometer. This enables the magnitude and phase of the current to be determined in the portion of the cable where the measurements are being made, and eliminates the effect of attenuation, which may be of importance at frequencies of 1,000-2,000 cycles per second up to which it is proposed to carry the observations.

To keep the barge in a definite position relatively to the cable when observations are being made, a rope is run from the pier to a mooring in the Gareloch, and passes over a winch drum on the barge, so that it can be warped along the rope into any position. Ranges will be taken by a 9-ft. Barr and Stroud range finder installed in the observation hut.

In connection with these tests a second series of observations will be made on the electromagnetic field produced by circular and square coils when submerged. This is not only of great theoretical interest, but has an important bearing on the question of electromagnetic detection.

An appendix to the lecture gives an outline of the mathematical treatment of the subject, and a table of absorptions of plane electromagnetic waves of various frequencies is attached. For the purpose of this calculation a reliable determination of the specific resistance of sea water was required, and a Kelvin double-bridge arrangement was devised for the purpose. The measurements gave a specific resistance of 27 ohms per cm. cube for water from Harwich Harbour mouth, and of 24 ohms per cm. cube for open sea water off Weymouth, with a temperature coefficient of minus 3 per cent. per deg. C. in each case. These values were found to be independent of current frequency and dimensions over wide limits. Other appendices deal with the theories of acoustic transmission and of 3-station sound ranging.

Another point of great interest is the existence of electrical currents in the sea due to tidal and wave motion in the earth's magnetic field, which were predicted by Faraday, and have been experimented with by Dr. F. B. Young. These require investigation, as their behaviour is complicated by the nature of the channel or sea bed. It is possible that their elucidation may have important consequences in relation to submarine telegraphy.

As regards the future, as soon as the above-mentioned fundamental researches on transmission for which the Gareloch is specially suitable are completed, which will take about a year, the Shandon Experimental Station will be transferred to a new Admiralty physical laboratory to be built close to the National Physical Laboratory at Teddington, the sea experiments being conducted at Portsmouth or elsewhere. The general direction of scientific research at the Admiralty is now in the hands of the new Director of Scientific Research, Mr. F. E. Smith, F.R.S., who is co-ordinating the pure scientific research and experimental work with the developmental work of the existing naval stations. It is hoped in this way to obtain the maximum of efficiency and co-operation without undue overlapping.

It appears probable that immense gain as regards navigation will result from the work already done and in progress; the results already achieved are remarkable, and form a tribute to the initiative and resourcefulness of British scientific workers. It only remains to add that the work has been continued since the end of the war without any abatement of enthusiasm or energy, although with greatly reduced numbers.

Scientific and Industrial Research.—The Committee of the Privy Council for Scientific and Industrial Research has just issued its fifth annual report (Cmd. 905, H.M. Stationery Office, price 1s. net). The report states that the programme of the department can now be classified under four main heads, viz.: The encouragement of the individual research worker; the organisation of national industries into co-operative research associations; the direction and co-ordination of research for national purposes, and the aiding of suitable researches undertaken by scientific and professional societies. As regards the first class of work, since the department's inception 136 maintenance grants have been made to students and 89 to independent workers. Forty-nine grants have been made to provide professors with competent research assistants, and 87 to give them other assistance, and during the same period 49 equipment grants have been made. Expenditure in this direction has increased from £3,207 in 1916-17 to about £26,700 this year. Eighteen research associations have been established, and five others will shortly receive licences. Ten of the associations have raised from their 2,300 members an aggregate income of £40,000. £63,800 has already been expended out of the million-pound fund granted by Parliament for research associations, and commitments stand at £450,000 for established bodies, and £120,000 for those approved but not licensed. Negotiations are now proceeding for the establishment of other research associations, and the total commitments are expected to reach £800,000 shortly. Over 2,500 firms have guaranteed an aggregate amount of £38,400 a year for five years. In addition to a review of the subjects of national importance specially dealt with, the report gives the *personnel* of the various committees and sub-committees appointed, as well as a list of publications by individuals in receipt of grants. The report is very fully indexed.

THE MUNICIPAL TRAMWAYS ASSOCIATION

(INCORPORATED.)—III.

Photo by] [*Whitlock & Sons.*

THE MUNICIPAL TRAMWAYS ASSOCIATION AT CARDIFF.

Operating Costs: Power Expenses.

By A. L. C. FELL

(General Manager, London County Council Tramways.)

(*Abstract.*)

Fuel.—The principal item of working expenditure, in order of magnitude, connected with the generation of electrical energy is fuel, and as this now represents from 75 to 80 per cent. of the cost of producing electrical energy at the power station, it is well worth while to see what can be done to effect economies.

Before the war it was possible to issue a fairly close specification for coal, and payment was made for value received. Since 1914, however, anything available has had to be taken, and absolute rubbish has been supplied in innumerable instances, notwithstanding all the complaints made to the authorities concerned.

To-day the situation is still unsatisfactory. The following particulars with regard to the coal supply to the London County Council's Greenwich Power Station may be of interest:—

	1913–14.	1919–20.
Tons of fuel burnt	166,040	176 400
Total cost of fuel burnt	£139.577	£348,395
Average price paid per ton for coal ...	16/9¼	41/11·3d.
Average calorific value British thermal units	13,350	10,780
Average percentage of ash	6·79	14·59

It will be seen that the fuel supplied in 1919-20 contained 7.8 per cent. more ash than that supplied during 1913-4, or a total increase in the waste material supplied to the station of 13,759 tons. This waste material, paid for at 41/11.3d. per ton, represents a dead loss of £28,854 during the year. In addition, the extra cost of barging away the ashes at 3s. 8d. per cubic yard amounted to £6,306, and owing to the increasing cost of labour, this figure will become more serious as time goes on. The present cost of barging amounts to 4s. 9d. per cubic yard, or a total cost of barging the above quantity of ash would amount to approximately £8,170. In addition to this, it has been necessary to incur very heavy expenditure at the station for labour in connection with the removal of ashes. The figures quoted would have been considerably higher, as a larger amount of fuel would have been consumed in 1919-20, if it had not been possible to bring into commission more economical generating plant.

The arrangements with regard to grading coal should be co-ordinated by the suppliers and transport agencies, so that the lowest-grade coal may be utilised where the least transport is necessary, and the quality should improve as the distance from the source becomes greater. By the exercise of a little common sense on the part of the suppliers and distributors, considerable economies might be effected at once. The Government should be pressed to take action.

The introduction of oil fuel in generating stations, which are not situated in suitable positions to obtain coal gas at the collieries, would offer great advantages. One of the principal items of expenditure in connection with fuel is transport, and oil could be delivered in bulk under advantageous conditions at a minimum cost for labour. In this form fuel could be made available containing a very small percentage of waste material.

In the autumn of 1917, under-feed grates were fitted to four boilers at the Greenwich Power Station, with a view to burning coke for steam raising. At first the results were not very successful, but after many experiments had been carried out, a type of arch was found, with which satisfactory results were obtained, and, at the price of coke at that date, considerable saving was effected by burning coke on these grates.

Early in 1918, experiments were also carried out at Greenwich, with a view to burning coke on the "sandwich system" on the Stirling boilers, *i.e.*, a layer of coke was laid on the grate with a layer of coal above it. These experiments proved successful, and, when the Coal Controller decided to curtail coal supplies by 15 per cent., it was found possible to make up the deficiency by using coke in this manner. The results obtained were so satisfactory that the Coal Controller recognised them as being of public service, and arranged for engineers from other undertakings to inspect the lay-out, with a view to adopting a similar system.

Since that date, however, the price of coke has risen considerably, and, from a financial standpoint, there is very little advantage in using coke at the present time. Moreover, it is necessary to install special coke-cutting or crushing apparatus, and generally to alter the shoots for the supply of this fuel.

The question of storage is important, as broken coke occupies about 75 cubic feet and coke breeze occupies about 60 cubic feet, against 45 cubic feet per ton of coal, as coke has a calorific value of about 11,500 B.TH.U. per lb., with 10 per cent. of ash, whilst coke breeze has a corresponding value of about 9,000 B.TH.U., with 18 to 20 per cent. of ash.

During the year ended March 31st, 1920, about 25,000 tons of coke and coke breeze were burnt at Greenwich, representing about 14 per cent. of the total fuel.

With Scotch nuts at 42s. per ton, and coke breeze at 22s. 6d. per ton, the cost per thousand pounds of steam is approximately 19s. 6d. with approximately equal quantities of each fuel, as against 23s. 2d. with nuts alone. The coke was supplied from a gas works situated only a short distance from the station.

It has for some time been realised that it is essential to have a skilled boiler-house engineer who can devote his whole time to fuel combustion problems, but it should also be recognised that to get the best results it is necessary to have the assistance of a fully-qualified chemist at the station. At Greenwich this has been found a most economical arrangement; the chemist appointed is lent to the tramway department, and works under the direction of the Council's chief chemist, who himself is called into consultation as necessity arises. The duties performed by the chemist, so far as the boiler house is concerned, are as follows:—

1. Tests of fuel to determine calorific value, moisture, &c., both on supplies received and on representative samples taken from the bunkers.

2. Test of furnace ash, to ascertain whether all the combustible matter has been fully utilised.

3. Tests of flue gases, to determine whether the fuel is being burnt to the best advantage.
4. Tests of boiler feed water and condensate, to ascertain whether impurities likely to affect the boilers and plant in an adverse manner are present.
5. Tests on boiler water, to determine the concentration of salts and the necessity for blowing down.
6. Tests on water before and after softening, and on the lime used for this purpose.

In addition, tests are carried out on deposits from leaking steam pipe joints and in all cases of boiler corrosion.

In cases where the generating station is not large enough to justify the appointment of special officers for the purpose, arrangements might be made by the municipality for this work to be done in conjunction with other chemical investigations.

Further Possibilities of Economy.—The London County Council approved a scheme granting 50 per cent. of the value of the direct saving in fuel due to decreased consumption of electrical energy effected by motormen and conductors in the operation of the Council's tramways. The scheme has not been so successful as was anticipated, but it is formulated on right principles. The influx of new men since the scheme was introduced has militated against its success, but it is still believed that, with the co-operation of the men, it is possible to make a scheme of this description a success.

On a system such as that in London, where there is an enormous peak load for a brief period in the morning and again in the evening, trailer cars have proved to be very economical, especially from a power-saving point of view, and a recommendation is now being put forward to the Ministry of Transport for an extended use of trailer cars on the London County Council system.

Statistics obtained from metered readings, &c., on cars in regular service in London, with and without trailers respectively, averaged over a period of 45 weeks, gave the following results:—

Tractor and trailer	2.87 units p.c.m.
Tractor only	2.04 units p.c.m.

Thus the average energy consumption for a car and trailer is only approximately 30 per cent. higher than that for tractor only. The passenger seating capacity of the tractor was 78 and for trailer 46.

In 1912 a series of tests were carried out, when the average current taken for a tractor car was found to be 1.8 amps. per passenger, and for tractor and trailer combined 1.22 amps, or a reduction of 32 per cent. per passenger, due to the employment of the trailer car. The passenger seating capacity of the cars used for this test was tractor 62 and trailer 46; the cars were loaded with sand to approximate fully loaded service conditions. It should be noted that the journals of all the trailer cars in London are fitted with radial ball bearings. Tests taken on the level showed the tractive effort at the drawbar to be 17.02 lb. per ton of load with these bearings, as against 38.03 lb. per ton of load when the journals were fitted with bronze bearings, and to this fact the low energy consumption can be partly attributed.

The generating station staff really only has to deal with the economies which can be effected in connection with production and reference must be made to those responsible for the consumption of the power so produced. For instance, the traffic staff is responsible for the proper and economical operation of the cars; the prevention of unnecessary stopping and starting, brakes being applied with power on, reckless speeds, &c. The rolling stock staff is responsible for proper equipment and subsequent maintenance of the cars, by neglect on its part the consumption of electrical energy may go up by leaps and bounds; items like trucks out of line, tight brake blocks, armatures on pole pieces, defective gears, defective lubrication, &c., all require constant attention. Again, the permanent way staff may also be responsible for increasing consumption due, *inter alia*, to rails not being to gauge, rails being so worn or paving so defective that motor cases drag on the road, or defective track, which may make it impossible to drive cars at an economical speed, dirty track, also power wasted when grinding or welding rails, &c.

It will thus be seen that all sections of a tramway department are responsible in some degree for the consumption of electrical energy, and it shows how necessary it is, if the best results are to be obtained, that, not only should the officers co-operate and study the position from a broad point of view, but the employés in all sections should be brought into touch with the work as a whole by regular lectures and demonstrations. So far, schools have been principally provided for the education of motormen in their duties. These should be extended, so that the education of all employés, as far as the tramways are concerned, may be made a strong feature of the organisation. Anything which makes the employés more competent and interested in their work will benefit the undertaking.

One wishes it were possible to institute some scheme under which the staff and the employés would have a direct financial interest in the success of the undertaking. This would have a very direct effect, not only in the reduction of power expenses, but in the whole financial results. It is certainly a matter which should be considered by the Whitley Council.

A large number of municipal undertakings obtain their power supply from the lighting department. A Joint Committee of the Incorporated Municipal Electrical Association and the Municipal Tramways Association was set up and issued a detailed report "On Charges for Electrical Energy supplied for Traction Purposes from Combined Stations," in September, 1911, but as changes may have taken place it would be advantageous if the basis of charge could be reviewed at the present time. The executive might be instructed to take the matter into consideration, and, if necessary, confer with the Incorporated Municipal Electrical Association.

An endeavour has been made in this paper to show that, even under one head of account, such as power expenses, there are vast numbers of unexplored problems which are worthy of consideration with a view to effecting further economies, and thus proving that the anti-tramway cry that "tramways are dead" and "their day is done" is not true and is only used by those who do not think, or by those who have induced local authorities to provide road tracks free of cost for the use of their free-lance passenger transport vehicles.

Tramways in the past have rightly or wrongly borne many burdens, and, when comparing one form of traction with another, it is necessary to consider the *whole cost* of providing the services rendered, if justice is to be done. Even if the matter is judged on the question of power expenses alone, there is no cheaper form of vehicle on the streets of a busy city to-day than the electric tramcar.

Discussion on Mr. Fell's Paper.

Clr. Failin (Bradford) referred to the advantages of co-operation, and pointed out that the Works Committees, which had not yet been started, would facilitate it.

Mr. C. J. Spencer (hon. member) agreed that it was most important to economise power, and regretted to hear that the L.C.C. bonus scheme had not succeeded. He had put in operation a bonus scheme during the war which effected a reduction of 15 to 20 per cent. Afterwards the men asked for an equivalent increase of wages instead of the bonus, assuring him that the standard attained would be maintained; he agreed to this, but the result was that the consumption of energy was as high as ever again. He believed in the system of payment by results. Ball-bearings had been found useful on trailer cars, and might equally well be fitted on motor cars. As tramway men, they were not looking far enough ahead. There was no cheaper vehicle on the street than the tramcar, but it could be made a good deal cheaper still. The Association should give attention to the technical side of the business. He had seen a motor of one-third the weight, and 10 per cent. higher efficiency than the ordinary motor; it was shunt wound, and had a worm drive. There was clearly room for great improvements to be made.

Mr. Cunliffe (Metropolitan-Vickers, Ltd.), speaking as a former member, having been connected with the Manchester Corporation tramways, said that the running costs could be reduced by increasing the efficiency of the cars. To that end they needed new machinery, on new principles, with better construction, and running at lower temperatures (the temperatures now attained destroyed the insulation). New designs were already available, with better insulation, more durable gearing, &c. The cost would be an immediate burden, but in five years it would be paid for by the saving effected, and in that period there would be no maintenance cost to speak of. In many undertakings the capitalised equivalent of the maintenance was greater than the actual cost; one London undertaking was spending 20 per cent. of the original cost on maintenance annually. In other directions also, such as the construction of controllers, car-bodies, and trucks, the tramways were years behind the motor-car industry. They were not using special steels or aluminium, or machined joints in their trucks, or roller bearings; one Corporation, however, had 60 sets on order with roller bearings, which not only reduced friction losses, but also ensured that the armature would never touch the poles. Further, power brakes should be employed; all American and many Continental undertakings used them. An American compound wound motor had been introduced with shunt control, giving two running notches in series as well as parallel, without resistance losses, making a saving of 20 per cent. Single-helical gearing reduced noise and vibration, and had five times the life of straight-toothed gearing, partly owing to heat treatment. The maintenance cost of any tramway system over ten years old could be reduced to one-tenth its present value by the adoption of new designs.

Mr. A. R. Fearnley (Sheffield) took exception to Mr. Cunliffe's denunciation of British tramway practice; having had 30 years' experience with tramways and eight with motor 'buses, he denied that they were behind the times. Mr. Cunliffe's remarks apparently applied to the American equipments of ten years ago. He had tried American power brakes, and scrapped them, and was now trying air brakes. On the Sheffield tramways every gear-wheel was hardened and giving a long life; he had tried helical gears, and watched them melt away. British practice was cautious and sound.

Mr. R. H. Campion (Chesterfield) said he was burning six times as much coke as coal, hand fired—but not gasworks coke. He had tried to introduce bonus schemes, but his committee would not adopt them; as long as CO_2 recorders worked well, the stokers would take an interest in their work and save fuel.

Mr. Fell briefly replied.

Report and Accounts.

The report of the Executive Council showed that the total membership was:—Ordinary members (local authorities) 91, (general managers) 92; associates 21. The total number of local authorities owning and working tramways was 98.

The representatives of the Association appointed to serve on the panel of experts to advise and assist the Minister of Transport were Messrs. A. Baker, J. Dalrymple, A. R. Fearnley, A. L. C. Fell, G. W. Holford, J. M. McElroy.

During the current year, the period of five years covered by the existing agreement with the Board of Inland Revenue will expire, under which the rate of annual allowance for wear and tear of motor omnibuses was fixed at 20 per cent. on the written down value. At the request of the Board, Messrs. Baker and Fearnley, with the General Secretary, were appointed to represent the Association at the Conference of other organisations concerned, and the Board, to reconsider the subject.

With regard to the proposed increase of taxation upon mechanically propelled road vehicles, the Association asked the Minister of Transport to bear in mind the equitable claim of tramway authorities throughout the country in any scheme for the distribution of taxation derived directly from road vehicles.

The Special Committee appointed in 1917 (upon which representatives of the Tramways and Light Railways Association were also appointed) to consider the standardisation of overhead line material, completed its report after having held 30 meetings.

The report (with suggested specifications and illustrative drawings) was approved by the Executive Council, which resolved that the present members of the Special Committee be constituted a Standing Committee.

On July 9th a letter was addressed to the Secretary of the Rates Advisory Committee, stating that the Association had laid down the general proposition that tramways should be self-supporting and should not depend upon compulsory local taxation for any subventions to meet deficiencies in revenue. This proposition had been concurred in by the National Joint Industrial Council for the tramway industry. Owing to the substantial increase in wages and the enormous increase in the cost of materials and all operating charges, as well as in the rate of interest now paid by all local authorities, over 75 per cent. of the municipal tramways would, according to the Budgets for the current year, be carried on at a loss, and some of them were receiving material rate-aid.

In assessing a new scale of fares, the Executive Council urged that the time was now ripe for the abolition of charges for workmen's cars that were in general operating at a loss, which loss must fall upon (*a*) either another class of passenger, many of whom were now receiving lower rates of wages than such workmen, or (*b*) the whole local community in the shape of local rates. This resulted in a great social injustice, which rested on no sort of principle, and which was no longer defensible.

The Executive Council decided to recommend the establishment, during the current year, of a quarterly journal, to be called "The Journal of the Municipal Tramways Association," as the official medium by which members might be informed, continuously, of all official proceedings relating to the tramway industry; of the proceedings of the National Council, and the Standing Committee of that Council, and of the decisions arrived at between the various Ministries of State and the Association.

The gross revenue from the tramway undertakings operated by the local authorities in membership during the financial year, 1919-20, was £23,056,945.

Interim Orders have been granted to 27 tramway undertakings, authorising increases in the statutory maximum charges under the Tramways (Temporary Increase of Charges) Act,. 1920.

The accounts showed receipts £4,482, expenses £4,255, leaving a surplus for the year of £227. The receipts included £3,066 for the annual subscriptions of local authorities, together with £1,354 special subscriptions to defray the cost of the wages arbitration proceedings in September and October, 1919. Amongst the expenses were those of the representatives attending meetings of the National Joint Industrial Council for the Tramway Industry, its committees, &c., amounting, with printing, &c., to £1,125. The wages arbitration expenses were £1,376.

Japanese Exports.—It is stated that the value of the exports of electrical machinery, apparatus, lamps, wire, and insulated conductors from Japan in 1919 amounted to 16,709,000 yen, being a reduction of 3,167,000 yen, as compared with the preceding year. Shipments to Russia, including Siberia, were brought to a standstill, but no noteworthy diminution took place in the exports to China, India, and the South Pacific countries. During the first two months of 1920 the exports of machinery and apparatus were of the value of 528,000 yen (380,000 yen in corresponding period of 1919), electric lamps 150,000 yen (314,000 yen), telephone apparatus 259,000 yen (39,000 yen), copper wire 415,000 yen (242,000 yen), and insulated wire 1,030,000 yen (1,649,000 yen).

THE MACHINE-TOOL AND ENGINEERING EXHIBITION.

(*Concluded from page* 416.)

Messrs. John Stirk & Sons, Ltd., Halifax.—During the war, upwards of 2,500 machine tools were made by the firm for various Government factories, including a record order for planing machines for the heavy gun programme, 5 ft. × 5 ft. × 16 ft. machines, 117 being actually delivered at the time of the Armistice. Since the cessation of hostilities, concentrated attention has been given to the production of planers and boring mills; eight sizes of belt-driven planers, 12 sizes of Stirk hiloplanes, and 12 sizes of boring mills comprise the full range of machines at present undertaken, but these are cut down to six standard size planers, three hiloplanes and three boring mills for quantity production, and an example from each of these three lines was included in the exhibit, which consisted of the following machines, all shown in operation:— A 5 ft. × 5 ft. × 16 ft. Stirk hiloplane, exhibited in public for the first time, although examples have been in use for five or six years. The hiloplane, fig. 27, is entirely electrically-controlled, having in addition to electrically-operated table mechanism, electric control of tool boxes, both automatic feeds and quick power traverses. The whole of the patents, including reversing motor drive and controls, are from original Stirk designs. A small Stirk planer, 2 ft. × 2 ft. × 5 ft., which embodies some of the outstanding features of the hiloplane, including plate bed. A 42-in. boring mill, complete with 7½-h.p. variable-speed motor. The drive may also be by constant-speed belt or motor through six-speed gear box.

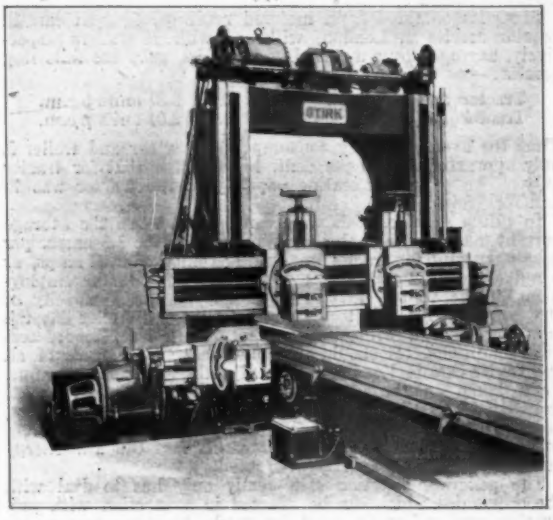

Fig. 27.—Electrically-Driven Planer, Regenerative on Reverse.

The Stirk split field drive for planers, &c., is of much interest to both electrical and general engineers. The earliest automatic reversing motor drives consisted of a D.C. motor reversed by reversal of the armature current and controlled by one form or another of self-acting starter. Save in special cases, this system has almost entirely given place to some variety of the Ward-Leonard control. Prior to 1915 the chief example of this system was the well-known "Lancashire Patent Drive," in which the generator field connections were reversed by means of a three-pole change-over switch operated by dogs and levers from the planing machine table. The Lancashire-Stirk drive is an improvement on the Lancashire drive, the principal difference being the Stirk disk and master switch actuating a set of five contactors which constitute the reversing switch proper, and take the place of the oil switch. Over 100 Lancs.-Stirk drives have been sold during 1917-1919. To this record is added the fact that Stirk motor-driven planers have been supplied to six of the most important electrical firms, and to over 12 of the leading machine-tool makers. The equipment consists of a motor-generator, motor, master switch, starter for primary motor, contactor and regulator panel for generator, start, stop and inching buttons. The disk and master switch are retained to actuate two contactors which, without any other switchgear whatever, will provide a quick-return reverse to the table motor. This is accomplished by the division of the shunt field windings of both generator and final motor into two sections. In the case of the generator, the sections are connected to oppose each other, so that alternative polarity results from the alternative excitation of the two sections. The two sections of the motor field are connected to agree, and one is permanently excited. The second section is excited during the cut stroke only, and a slow cutting speed and a quick return are thereby provided. The "natural" range of the system may be extended indefinitely by the variation of the generator voltage, and the standard equipment embodies two shunt regulators, enabling cutting and return speeds to be varied independently.

The City Electrical Co., Ltd., London, arranged to have samples of its small and fractional horse-power motors, together with a "City" light and power plant, exhibited on the stand of the Simoon Engineering Co., Ltd. It will be remembered that we described and illustrated the "City" plant on p. 318 of our September 3rd issue.

The Seal Co. (London), Ltd., Willesden Green.—This exhibit covered a range of dry cells, Leclanché cells, and specimens of electro-cleaning, tinning, and zinc plating. The dry cells are manufactured in London by what is described as a new method, which it is claimed enables the capacity output of the cell to be increased 20 per cent. over other types of cell. To fully appreciate the merits of the electro-cleaning, the specimens must be seen; all kinds of articles are handled from milk churns to 60,000-gallon vats and stills used by margarine makers and distillers. The process consists of first cleaning the utensil electrochemically (non-acid solution), and when the surface has been rendered free from dirt, rust, &c., a coating of new metal is deposited thereon. In the case of milk churns, for instance, the new inside coating consists of pure tin and the outside one of zinc.

Messrs. Bulpitt & Sons, Ltd., Birmingham.—On this stand were the "Better Skeem" system of electric localised lighting fittings and the "Tenbec" system of general lighting. The former system, it will be remembered, was referred to by H.M. Inspector of Factories, Mr. G. Scott Ram, in the Home Office report that was published at the beginning of this year. It is a low-voltage system of machine and bench lighting of a very novel character, and its advantages are at once apparent on inspection. The firm was also showing an improved self-sustaining conduit system for conducting cutting lubricant to the required points on machine tools. This is a new system also, and it includes a very fine (mechanically speaking) non-choke joint, which was developed concurrently with the lighting system referred to above. A variety of fittings of both these systems were exhibited, and some were fixed to a thread-milling machine driven by an electric motor, all of which were of the firm's own manufacture.

During the Exhibition, on September 21st, a convention of employers and employed was held, when a paper on "Unemployment, Production, High Prices, and World Competition," was read by the Rt. Hon. G. W. Barnes, P.C., M.P., and a discussion followed. The speaker pointed out that the four separate topics could easily form enough for one day's discussion each, and there was bound to be a little overlapping. Under the circumstances, the speaker could merely deal with them in a fragmentary way. The following is an abstract of his remarks:—

Unemployment is, perhaps, the most perplexing and vexing question of the day, and is a constant source of fear to the manual worker—shaping, to some extent, his mentality—hence his occasional distrust of the motives for the introduction of new methods and machinery. Reviewing the past 70 years, it would appear that unemployment was less acute during the last 35 years than before that period. There were many causes of unemployment; bad harvests abroad, causing poverty among foreign customers, and so leading to a slackening of demands; change of fashion; uncertainty of wages and conditions in the industrial world, when employers hesitated to take risks; the reverse—employers taking risks and failing. The main cause of unemployment was unbalanced production, leading to a scarcity in one commodity while there was a surplus in another direction, as witness the present housing shortage and boot surplus. Several methods of steadying employment are put forward. Public authorities should do something in the way of replenishing stocks during periods of depression; new methods and improved machinery should be introduced with due regard to the maintenance in employment of those replaced; industry should be "decasualised" and provision made for retaining in an industry only as many as can be employed for full time, and both employers' and employés' organisations should pay more attention to the necessities of labour as a whole. Insurance is regarded not only as a palliative, but will help in finding a panacea by causing a complete register of unemployed to be compiled. In reaching his next subject, Mr. Barnes said that many years ago over-production was thought to be the root of many evils. There can be no over-production over the whole field. There might be too little of some things, and therefore an inability to buy other things of which there might be a relative abundance. Production is the life-blood of a community, and the aim of life in all its best activities. Greater production ought to give greater comforts to everybody. The requisites of good production are not long hours or sweated labour, but chiefly the best machinery and good organisation. But these alone will not result in good production; they require the active co-operation of the human factor. That is what we have not got to-day, and to get it is the great need of the industrial world. Narrow conceptions of economics lead some to say that only an industrial revolution can bring this about, but this is the policy of despair, leading to the worker's undoing. Increased production in the past did not bring increased wages to the worker on account of cut-throat competition between employer and employer and between employed and employed, but to-day these conditions have been altered by better organisation and better disposition. Resuming his remarks after the luncheon, Mr. Barnes said that the question of high prices was a ticklish topic full of pitfalls for the unwary and illusions for the ill-informed. The inflation of the currency by the printing press is one of the simple causes of its depreciation or cheapness, or, in other words, high prices. Inasmuch as money is the measure of all other commodities, there can be no great fall in price until there is increased production of other commodities or a lessened amount of paper money in circulation—or both. The constant rise of prices and of wages is an absurd proceeding, as, travelling at the same speed and in the same direction, they can never reach a level. Engineering productions are scarce, but the real demand is determined to a great extent by the price. A reduction in price is, therefore, a necessity, and only mass production can enable this to be made. This leads to the subject of world competition. We are more concerned in this than most other countries, because we have to purchase food abroad, while producing things we cannot eat. Therefore, if we cannot produce and dispose of the things we manufacture to buy our food as good and cheap as other countries, our foreign trade will disappear. Food production in this country has declined, and yet our prices for certain goods are so high that even home consumers have to go abroad with their orders, as witness Glasgow Corporation Tramways Department, which is buying steel rails from America. Coal is also produced in smaller quantities. Our engineering products are supreme in quality, and we must keep that supremacy and add quantity to it. Steel workers in America are still working 10 or 12 hours a day, and this will have to be dealt with by the World Regulating Organisation, which America should enter, and help in maintaining the peace and improving labour conditions everywhere.

THE PROVINCIAL ELECTRIC SUPPLY COMMITTEE OF THE UNITED KINGDOM.

Annual General Meeting.

At the annual general meeting, on Tuesday last, the chairman, Sir Harry Renwick, K.B.E., said that his prediction that the year 1919 was likely to be one of the most momentous in the history of the industry had been fully borne out by the facts of the past year. The Electricity (Supply) Bill had become an Act, in, he was happy to say, a considerably modified form. In that modification the Committee took a leading part. The point of vital concern to the companies was the compulsory purchase of their generating stations and transmission lines, which was to be imposed upon them under the Bill on terms most inadequate and unfair. Throughout the long process of the Bill the Committee watched their interests clause by clause, and put forward innumerable amendments. The Committee met with much more favourable consideration in the House of Lords than in the Commons, and after very great effort, succeeded in getting the Bill amended to its present form, and thus at the eleventh hour saved the situation. Strenuous work was thrown on the Executive Committee in the many weary months during which the Bill was before the two Houses. Special thanks were due to its members, and particularly to those who formed the Parliamentary Sub-committee; he emphasised their indebtedness to Mr. Madgen, Mr. Gripper, Mr. Scott-Moncrieff, Mr. Spencer Hawes, Mr. Wigham, and Sir Henry Mance, as well as their parliamentary agent, Mr. Sydney Morse.

The next matter of importance dealt with during the past year was the National Joint Industrial Council for Electricity Supply. This Council had been placed in full working order, and District Councils had been formed throughout the country. The Councils' work had met with a considerable measure of approval from both sides, and certainly in the electrical industry the system appeared to have worked better than in any other that he was aware of. Every important matter relating to wages and conditions of employment had been reduced to system throughout the country. Every undertaking came under some council which relieved it of all trouble in considering questions of general advances, and so on, and submitted a recommendation on any and every point of labour which might come up for consideration. They had seen something of the usefulness of the National Joint Industrial Council in the recent threatened strike. Speaking broadly, he was convinced that for the present industrial unrest, salvation lay in the closer union and a better understanding between masters and men, and the entire elimination of the politician and Government interference. The politician should be kept out of wages disputes, and these should be settled by competent tribunals representing both sides. Co-operation between masters and men was the only way to industrial peace and to increased production, without which they were heading straightway to national disaster. The Ministry of Labour organised a scheme for providing suitable employment for disabled soldiers, including monetary grants, where training was necessary. The scheme was a large and elaborate one, and a National Advisory Council was formed to administer the funds and carry out the scheme generally. He was asked by the Ministry to sit on that Council, and with the approval of the Executive Committee he accepted a seat. Under the scheme the country had been divided up into districts, each with its local advisory committee, and at the request of the Ministry they had arranged, so far as their members were concerned, for engineers of the representative undertakings to sit on the local committees where possible.

A further Courts (Emergency Powers) Act was passed last year, entitled "Courts (Emergency Powers) Act, 1919," and the Committee took energetic action and obtained a very satisfactory amendment by which electric supply undertakings had been placed in the first section of the Act which provided power to amend agreements. Under the original Act they had no power to amend, but only to suspend or annul a contract.

Messrs. Edmundsons promoted a Bill to introduce a new basis for charging for electric supply, but the Bill was rejected; their enterprise in promoting such a Bill, although unsuccessful, had its fruits in inducing the Ministry of Transport to give immediate consideration to the question of introducing a general Bill, which, he understood, included a provision to reduce the five-year period between times of application at present provided by the 1899 Act. It would also bring those companies under the Act which were now excluded, owing to their orders dating prior to 1899. Further, in regard to tariffs, they were trying to obtain recognition of an alternative on an assessment basis on some method other than a flat charge. The Committee was largely influential in obtaining the re-introduction of the minimum charge.

The Committee had a member representing it on the British Engineering Standards Association, and was also supporting the Electrical Development Association.

Since the close of 1919, several matters of importance to the industry had occurred. Chief amongst these was the Electricity (Supply) Bill, 1920. There was great opposition to the Bill generally in the House, apart from the opposition of the electric supply industry; the Bill was introduced as far back as April, and it had been postponed from week to week ever since.

The Electricity Commissioners had put into operation their powers of delimiting areas under the Electricity (Supply) Act, and eight areas had been provisionally delimited.

The Committee had met all general expenses out of the annual subscriptions, and there was a balance to the good of £285 at the close of the year. As regards the expenses of the Electricity (Supply) Bill, for this they had to raise a special fund; there was a full and ready response to their appeal, and the whole of the expenses were covered by that fund.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

26,182. "Electric soldering iron." E. Wheatcroft. September 13th.

26,194. "Electric geyser." W. A. Powell. September 13th.

26,224. "Combined head-lamp and electric horn." Soc. Anon. des Anciens Etablissements Secqueville et Hayau. September 13th. (France, October 2nd, 1919.)

26,241. "Wireless telegraphy." S. Brydon and S. Johnson. September 13th.

26,242. "Lighting systems for automobiles, &c." E. A. S. Gater, W. R. Perry, and H. Starck. September 13th.

26,244. "Syntonisation of circuits used in wireless signalling." R. C. Galletti. September 13th.

26,246. "Electrolytic cell." J. Harris and J. R. Rose. September 13th.

26,257. "Electric induction motors." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. September 13th.

26,267. "Electrode holders." R. W. Heasman. September 13th.

26,268. "Indicating ringing of electric bells, &c., to operators." F. G. Bell, F. Clark, and Sterling Telephone & Electric Co. September 13th.

26,273. "Automatic electric circuit breakers." P. H. Bastie and E. F. Moy. September 13th.

26,295. "High-voltage indicator." F. A. A. Ellmore. September 14th.

26,315. "Means for operating magneto of internal-combustion engine." F. Laguesse. September 14th.

26,317. "Submarine telegraph apparatus." K. E. Edgeworth. September 14th.

26,344. "Electric batteries." W. T. Coulson and Optalyte, Ltd. September 14th.

26,347. "Electric power distribution systems." British Thomson-Houston Co. and H. Trencham. September 14th.

26,354. "Telephone transmitter mouth-pieces." C. E. O. Olliffe. September 14th.

26,382. "Electrically-operated warning signals." D. McGregor. September 15th.

26,386. "Electric current regulators, rheostats, &c." C. E. Falconbridge and C. E. Falconbridge, Ltd. September 15th.

26,396. "Junction boxes for electric cables." Greengate & Irwell Rubber Co. and R. Povey. September 15th.

26,408. "Supporting devices for overhead contact and trolley wires." J. W. Astley and British Insulated & Helsby Cables, Ltd. September 15th.

26,418. "Means for supporting telephone receivers." J. Lunzer. September 15th.

26,419. "Electrical turning gear for starting internal-combustion engines." F. H. Royce. September 15th.

26,447. "Electric transformers, &c." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. September 15th.

26,461. "Electric switches." Maschinenbau Akt.-Ges. Seebach. September 15th. (Germany, January 20th.)

26,473. "Rotating field magnet for high-speed electric machines." M. Gruber. September 15th. (Germany, September 15th, 1919.)

26,516. "Electric lighting device." F. G. Parks. September 16th.

26,525. "Releasing devices for overload switches." F. Krupp Akt.-Ges. September 16th.

26,535. "Engine-starting apparatus." J. K. Delano. September 16th.

26,538. "Ringing arrangement for carrier signalling systems." Western Electric Co. (Western Electric Co.). September 16th.

26,539. "Distribution for magneto." Etablissements Deesse. September 16th. (France, October 8th, 1919.)

26,540. "High-tension ignition magneto." Etablissements Deesse. September 16th. (France, December 27th, 1919.)

26,551. "Electric current generator for high-voltage ignition and lighting." J. Gehrig. September 16th. (Germany, September 16th, 1919.)

26,576. "Dynamo-electric machines." U.S. Light & Heat Corporation and A. E. White (U.S. Light & Heat Corporation). September 16th.

26,577. "Systems of electric control." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. September 16th.

26,582. "Telephones." G. Mathew. September 17th.

26,589. "Sparking plugs, &c." H. R. Doel. September 17th.

26,595. "Terminal protectors for sparking plugs." W. A. Clark and Sphinx Manufacturing Co. September 17th.

26,634. "Electric cooking and heating apparatus." M. Loewy and A. Rosenthal (Loewy). September 17th.

26,650. "Electric power limiting systems." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. September 17th.

26,654. "Repeaters for multiplex signalling systems." Western Electric Co. September 17th. (U.S., September 30th, 1919.)

26,655. "Means for actuating braking or stopping devices by electric current for rail vehicles." G. P. Bartlett and W. H. Taylor. September 17th.

26,676. "System for measuring capacities of electric conductors." Callender's Cable & Construction Co., R. N. James, and J. Urmston. September 17th.

26,683. "Electric conduit." J. S. Berry. September 18th.

26,686. "Electric burglar alarm." T. Fraser. September 18th.

26,711. "Wireless apparatus." C. E. G. Bailey. September 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

11,083. "Dynamo-electric machines." Soc. Anon. des Automobiles et Cycles Peugeot. May 6th, 1913. (Addition to 7,840/13.)

1919.

5,667. "Wireless telegraphy or other wireless control systems." Comparri Wireless Control Syndicate and M. Compare. March 7th, 1919. (150,008.)

7,463. "Marine signalling apparatus." C. Sampson. March 25th, 1919. (150,013.)

12,173. "Electrical receiving apparatus suitable for amplifying and recording weak electric current impulses." Creed & Co. and D. McLennan. May 14th, 1919. (150,025.)

12,821. "Wireless telegraph and telephone transmission." H. J. Round. May 21st, 1919. (150,037.)

13,004. "Magnetos." D. V. L. Fellows. May 23rd, 1919. (150,045.)

13,198. "Electric step-by-step signalling apparatus." B. E. D. Kilburn (Ford Instrument Co.). May 26th, 1919. (150,060.)

13,247. "Process for the continuous production of copper wire by electrolytical methods." S. O. Cowper-Coles. May 26th, 1919. (150,063.)

13,391. "Electrical impulse controlling devices." Automatic Telephone Manufacturing Co. (Automatic Electric Co.). May 27th, 1919. (150,072.)

14,422. "Electric condensers." R. W. Winn. June 6th, 1919. (150,096.)

14,909. "Trolley heads for overhead wire systems of electric traction." Brecknell, Munro & Rogers, and A. M. Willis. June 13th, 1919. (150,108.)

14,948. "Electric switches." R. P. Myers. June 13th, 1919. (150,109.)

15,070. "Electric switches." J. H. Tucker & Co. and J. B. Tucker. June 16th, 1919. (150,111.)

15,521. "Electricity collectors." British Insulated & Helsby Cables, Ltd., and J. W. Astley. June 20th, 1919. (150,120.)

15,596. "Rail bonds and like electric couplings or connections. J. Mather. June 20th, 1919. (150,122.)

15,789. "Electric contact or switches." V. Breeze and A. West & Co. June 23rd, 1919. (150,128.)

19,570. "Magneto-electric machines." British Thomson-Houston Co. and A. P. Young. August 8th, 1919. (150,165.)

20,696. "Locking device for electric and gas fittings." M. J. Railings, C. W. Saunders, and J. H. Collins. August 22nd, 1919. (150,170.)

20,920. "Electric storage batteries." W. Gardiner and W. H. Duggan. August 26th, 1919. (150,171.)

21,190. "Magnetos." M. Arioli et Cie. August 29th, 1918. (131,908.)

26,433. "Holders for electric lamps." W. C. Hands and Robinson & Hands Electrical Co. October 28th, 1918. (150,195.)

28,393. "Combined magneto and dynamo electric machine." O. Imray (Eisemann Magneto Corporation). November 15th, 1919. (150,204.)

31,909. "Electrolytic apparatus for the direct production of hypochlorites." P. Pestalozza. December 19th, 1919. (150,214.)

1920.

1,686. "Magnetos for igniting in internal-combustion engines." R. Bosch Akt.-Ges. November 21st, 1918. (138,081.)

2,712. "Magneto-electric ignition apparatus for internal-combustion engines." American Bosch Magneto Corporation. April 8th, 1919. (141,338.)

3,914. "Protective arrangements for alternating-current electric circuits." Siemens Bros. Dynamo Works and R. A. R. Bolton. February 9th, 1920. (150,231.)

6,907. "Meters used in connection with the batteries of electrically-driven submarines." Siemens Schuckertwerke Ges. December 5th, 1914. (139,822.)

7,797. "Electric time switches." Fabrik Elektr. Apparate F. Sauter. April 15th, 1919. (141,682.)

8,428. "High-frequency alternator." O. Billieux. November 22nd, 1917. (140,769.)

12,015. "Combined electric switch and terminal." G. B. Anderson and B. Bucknall. April 30th, 1920. (150,254.)

15,335. "Electrical fuses of the cartridge type." Metropolitan Vickers Electrical Co. July 5th, 1919. (146,941.)

18,168. "Electric switches." H. Sachs. March 13th, 1919. (145,784.)

Income-tax and Employés' Assessments.—Mr. W. R. Fairbrother, income-tax specialist, of 67, Cheapside, E.C., 2, writes pointing out that where a person is employed under a limited company in a subordinate capacity (*i.e.*, not holding a distinctive office, such as director or secretary, &c.), it is usual to grant a claim for assessment on the basis of the average of the three years preceding. Ex-service men come within this concession under certain conditions. It is vitally important that a claim to be assessed as stated for the year 1920-21 should be made, as, if the recommendations of the Royal Commission are carried into effect, the possibility of such a claim will not occur in future years. Many persons have doubtless made their returns on the disadvantageous basis of one year, but there is still time to rectify any such return; or the assessment which will be notified shortly could be appealed against.